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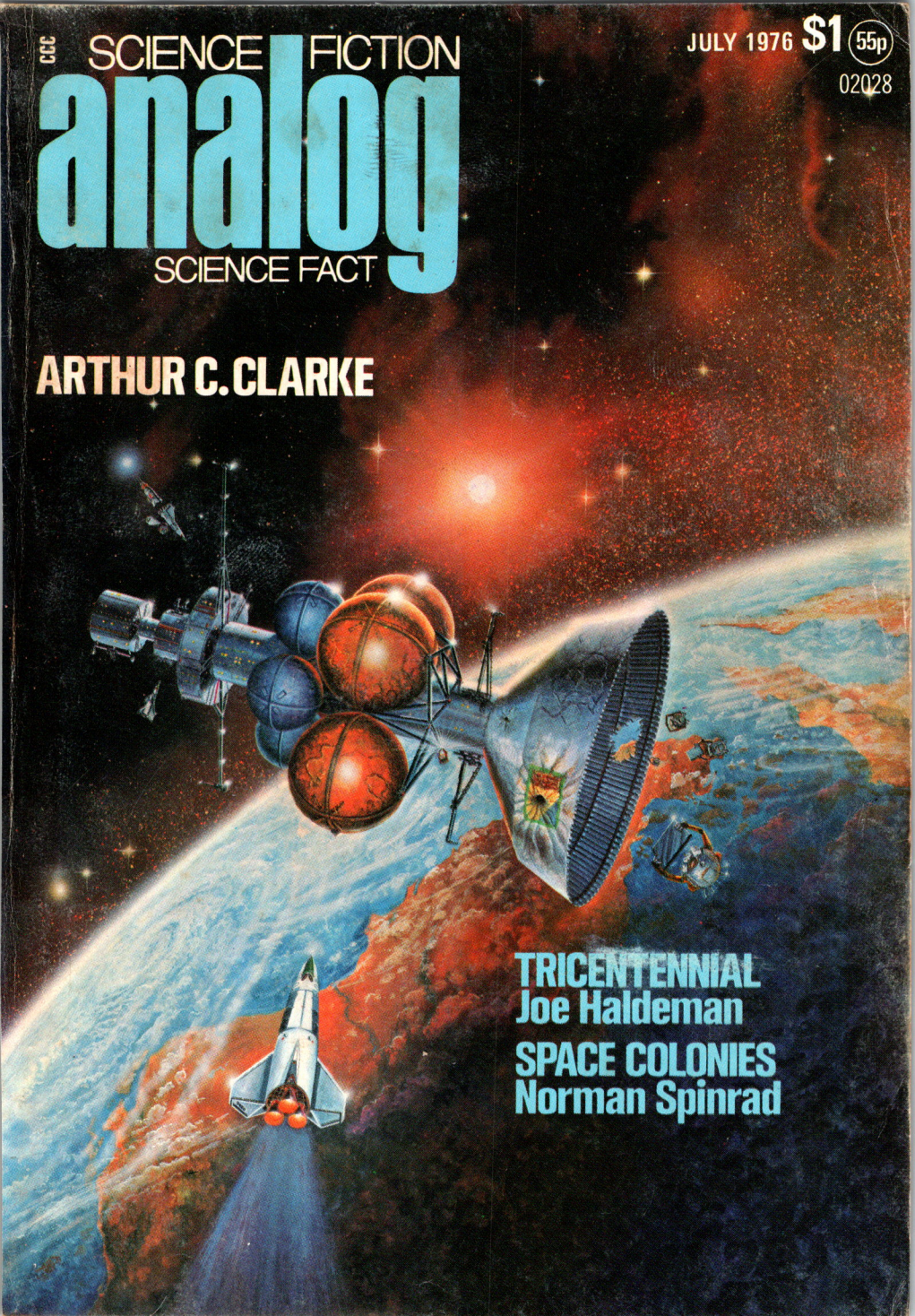

TRICENTENNIAL
Joe Haldeman

SPACE COLONIES
Norman Spinrad

ana log

A Calendar of Upcoming Events

18-20 June 1976
Meeting of the Science Fiction Research Association at Missoula, Montana. (Univ. of Montana, SFRA). Academic SF Conference. Registration $20. Info: Prof. Michael McClintock, Dept. of English, University of Montana, Missoula, Mt. 59801.

2-5 July 1976
WESTERCON 29 (West Coast Science Fantasy Conference) at Hyatt House Hotel, Los Angeles, Calif. Guest of Honor—H.L. Gold; Fan Guest of Honor—Gregg Calkins; Toastmaster—Robert Silverberg. Registration $3 supporting; $6 attending. Info: Westercon 29, Box 5384, Mission Hills, CA. 91345.

3-31 July 1976
World Game Workshop at University of Pennsylvania. 3-9 July: Planning Symposium (registration $200.00); 10-31 July: workshop (registration for both parts—$350.00). Info: Box 2016, Yale Station, New Haven, CT. 06520.

8-11 July 1976
Seattle International Star Trek Convention at Seattle, Wash. Info: SISTC, 280 Kipp St., Hackensack, NJ 07601.

30 July-1 August 1976
RIVERCON 2 at Louisville, Ky. (Louisville regional SF Conference). Info: FOSFA, Box 8251, Louisville, KY 40208.

2-6 September 1976
MIDAMERICON (34th WORLD SCIENCE FICTION CONVENTION) at Hotel Muehlbach, Kansas City, Mo. Guest of Honor—Robert A. Heinlein; Fan Guest of Honor—George Barr; Toastmaster—Bob Tucker. Panels, talks, masquerade, films; presentation of the Hugos and the John W. Campbell Award for Best New Writer. Registration: $6 supporting; $25 attending until 1 August 1976—$50 thereafter and at the door. The committee is handling all room reservations so don't write directly to the hotel. Info: Box 221, Kansas City, MO. 64141.

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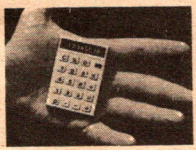

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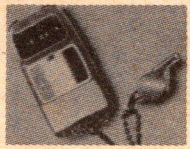

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SHORT STORIES

TRICENTENNIAL, Joe Haldeman 10
FLY, Mal Warwick 108
DOLLS' DEMISE, George Guthridge 158

SCIENCE FACT

SPACE COLONIZATION NOW: VISION AND REALITY, Norman Spinrad 30

NOVELETTE

HIS LOYAL OPPOSITION, Stanley Schmidt 120

SERIAL

MINOTAUR IN A MUSHROOM MAZE, Richard and Nancy Carrigan 48
(Conclusion)

READER'S DEPARTMENTS

GUEST EDITORIAL, Arthur C. Clarke 5
THE ANALYTICAL LABORATORY 157
IN TIMES TO COME 159
THE REFERENCE LIBRARY, Lester del Rey 160
BRASS TACKS 165

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MAN, SPACE, and DESTINY

Almost a year ago, on July 24, 1975, Arthur C. Clarke addressed the House of Representatives Committee on Space Science and Applications. His comments are uniquely appropriate to the Bicentennial spirit of America.—The Editor.

by ARTHUR C. CLARKE

Mr. Chairman, distinguished members of the Committee:

I am deeply grateful for the honor of appearing here today. Despite my reluctance to leave my home in the beautiful island of Sri Lanka, your invitation was an offer I couldn't refuse—not only for the pleasure of meeting you all but because of a rather strange literary coincidence.

Last year I finished my most ambitious novel, *Imperial Earth*, at the climax of which my hero addresses the United States Congress and gives it some advice on future space programs. However, this event takes place at the Quincentennial, 301 years from now.

May I therefore read you a few words from the *Congressional Record* for 4 July 2276 which nevertheless seem relevant today:

"Members of Congress, let me first express my deep gratitude to the Centennial Committee, whose generosity made possible my visit to Earth, and to these United States. I bring greetings to all of you from Titan, largest of Saturn's many moons—and the most distant world yet occupied by mankind.

"Five hundred years ago this land was also a frontier—not only geographically but politically. Your ancestors, less than twenty generations in the past, created the first democratic constitution that really worked—and which still works today, on worlds that they could not have imagined in their wildest dreams. . . ."

Then follows a brief flashback to the four earlier Centennials. Herewith the one that most concerns us:

"In 1976, the conquest of interplanetary space was about to begin. By that time, the first men had already reached the Moon, using techniques which today seem unbelievably primitive. Although all historians now agree that the Apollo Project marked the United States' supreme achievement, and its

greatest moment of triumph, it was inspired by political motives that seem ludicrous—indeed, incomprehensible—to our modern minds. And it is no reflection on those first engineers and astronauts that their brilliant pioneering effort was a technological dead end, and that serious space travel did not begin for several decades, with much more advanced vehicles and propulsion systems."

Then follows a proposal for a very advanced piece of space technology which I won't describe here, but which prompts some final rhetoric:

"How those scientist-statesmen, Franklin and Jefferson, would have welcomed such a project! They would have grasped its scope, if not its technology—for they were interested in every branch of knowledge between heaven and earth.

"The problems they faced, five hundred years ago, will never rise again. The age of conflict between nations is over. But we have other challenges, which may yet tax us to the utmost. Let us be thankful that the universe can always provide great goals beyond ourselves, and enterprises to which we can pledge our lives, our fortunes and our sacred honor."

So much for the *Congressional Record* for July 4, 2276. I hope I have nicely disoriented your time sense so that you are now free to take off into the future.

Now, there are two aspects to the problem of technological forecasting. The first is the ability to see that some development is possible or desirable—preferably both. The second is to know when the time is ripe to do something about it, because it can be disastrous to be a premature pioneer. My own country provides some classic examples of this: the steamship *Great Eastern* in the 1850s, the Comet jet airliner a hundred years later. But not, I hope, *Concorde*. . . .

From the nature of things it is very unlikely that one person can be qualified to give opinions in both these areas—i.e., ultimate feasibility and immediate practicality. For myself, I have always been more interested in the spectacular possibilities of the distant future and not the practical problems of the day after tomorrow. Indeed, I've summed this up in the warning that if you take me *too* seriously, you'll go broke—but if you don't take me seriously *enough*, your children will go broke. And I'd like to add another warning which should be engraved on the desk of every committee chairperson in letters of gold—DON'T GIVE ALL YOUR BASKETS TO ONE EGGHEAD.

I've discussed the perils and problems of technical forecasting in *Profiles of the Future*, where I've classified numerous past debacles under the headings "Failures of Nerve" and "Failures of Imagination." The "Failure of Imagina-

tion" prompted 'experts', only a lifetime ago, to pronounce that heavier-than-air flight was impossible—and space travel was not even worth discussing.

This particular failure is less common nowadays, because we have seen so many wonderful achievements that the public is prepared to accept almost any miracle of science or technology. In fact, the pendulum has swung too far the opposite way—towards overcredulity. Hence the unfortunate popularity of fraudulent or downright insane books about aerial crockery, antediluvian astronauts, emotional cabbages, Bermuda hexagons, and so forth, ad nauseum.

Perhaps we are more afflicted now by the failure of nerve—the appreciation that something is certainly possible, coupled with the assertion that it is too far ahead to be of any practical concern. This question of timing is the most difficult one in the whole area of forecasting, because it can result in total disagreement among authorities. Perhaps the best example of this occurred in a committee room not a stone's-throw from here. Listen to Dr. Vannevar Bush in 1945.

"There has been a great deal said about a 3,000-mile . . . rocket. In my opinion such a thing is impossible for many years. The people who have been writing these things that annoy me have been talking about . . . a rocket . . . so directed as to be a precise weapon which would land exactly on a certain target, such as a city. . . . I feel confident that it will not be done for a very long period of time to come. . . . I think we can leave that out of our thinking. I wish the American public would leave that out of their thinking."

Well the ICBM was then only ten years in the future. Yet there are few scientists to whom this country owes more than the late Dr. Bush, and in the total record I would not care to match my crystal ball against his.

It's a cliché that we often tend to overestimate what we can do in the near future and grossly underestimate what can be done in the more distant future. The reason for this is very obvious, though it can only be explained with a certain amount of hand-waving. The human imagination extrapolates in a straight line; but in the real world, as the Club de Rome and similar organizations are always telling us, events follow a compound interest or exponential law. At the beginning, therefore, the straight line of the human imagination surpasses the exponential curve; but sooner or later the steeply rising curve will cross the straight line, and thereafter reality outstrips imagination.

How far ahead that point is depends not only on the difficulty of the achievement but also upon the social factors involved. Let me give an example from my experience.

It is exactly thirty years ago this month that I wrote my paper on communications satellites. One of the reasons that I never attempted to patent the idea, apart from sheer laziness, was I simply did not expect comsats to be realized in my lifetime. Yet Early Bird was only twenty years ahead.

Why was this particular development so extraordinarily swift? Because a primary human need—that of communications—was involved. In what was historically a mere blink of an eyelid, the TV set left the lab and invaded every home, even the poorest. When the human race sees something it must have—and news, entertainment, and information of all kinds come high on that list—it insists on having it whatever the cost. All over this planet, TV antennae rear above squalid shacks. And, conversely, men show much less enthusiasm for other things that may be logically just as desirable but do not have the same emotional appeal.

Thus it may well be argued that the Earth Resources Satellite and the Meteorological Satellite have a potential economic impact as great as that of the communications satellite. But because they lack its glamour—they won't bring Mohammed Ali live from Kuala Lumpur—it is not so easy to convince the skeptical taxpayer of their value.

So much for generalities. Now I would like to come down to specifics, selecting just a few items from the enormous range of space possibilities.

I am rushing straight back from this hearing to Asia, because, as you are aware, one of the greatest educational experiments in history is due to start on 1 August: the use of the ATS6 direct-broadcast satellite to distribute TV to several thousand receivers scattered over India. Although the primary purpose of the experiment is to get information on family planning, hygiene, and agricultural techniques into remote villages, it is also hoped that no less than a quarter of all the teachers in India will be exposed to special training programs that will upgrade their efficiency. Thus even this limited one-year experiment could have far-reaching consequences, and it will be watched with great attention by the whole world.

I'm delighted to report that the Indian Space Research Organization is very generously shipping me an entire ground station so that I can set it up in my Colombo house, to demonstrate the programs to all the local educators and communications engineers. During the next few months, therefore, I hope to show my friends in Sri Lanka—which as yet has no TV service—the possibilities of this new medium.

I would like to see educational satellites spread over the world as swiftly as the communications satelites have done, but I realize that

the problems are much greater. Whether or not in this case the medium is the message, there is no doubt that success or failure will depend entirely on the software—the program content. That is expensive, but the potential audience is so enormous—billions rather than millions, over the course of years—that the investment would soon pay off handsomely. There may be no other way in which whole nations can be brought into the modern world within a single generation.

H. G. Wells once remarked that future history would be a race between education and catastrophe. 'Edsats' could help us to win that race.

Can you imagine *Sesame Streets* for the whole world? You may smile, but in many areas of knowledge it could be done. Despite the obvious problems of language, there are some subjects—e.g. mathematics, basic science—where a vast amount of information can be put across by sound and vision alone, without the use of words.

Some experts believe that the cost of providing direct-broadcast TV education to a medium-size country would work out at around a dollar per pupil per year. That's only the cost of the satellite and the TV sets; the software and personnel would work out at several times as much. Nevertheless one can envisage an educational satellite system covering the whole world—the educational equivalent of Intelsat—running for a few billion dollars a year.

It's hard to think of a more challenging or inspirational prospect. Just suppose that the United States, one of the two countries with the capability of providing the hardware, offered it to the entire developing world and not merely to India for a single year? I happen to know that, before its recent convulsions, the White House was considering some communications spectacular in connection with the Centennial. Even now that might not be too late.

In any event, direct TV broadcasting from space is inevitable, especially for countries that have no

continued on p. 171

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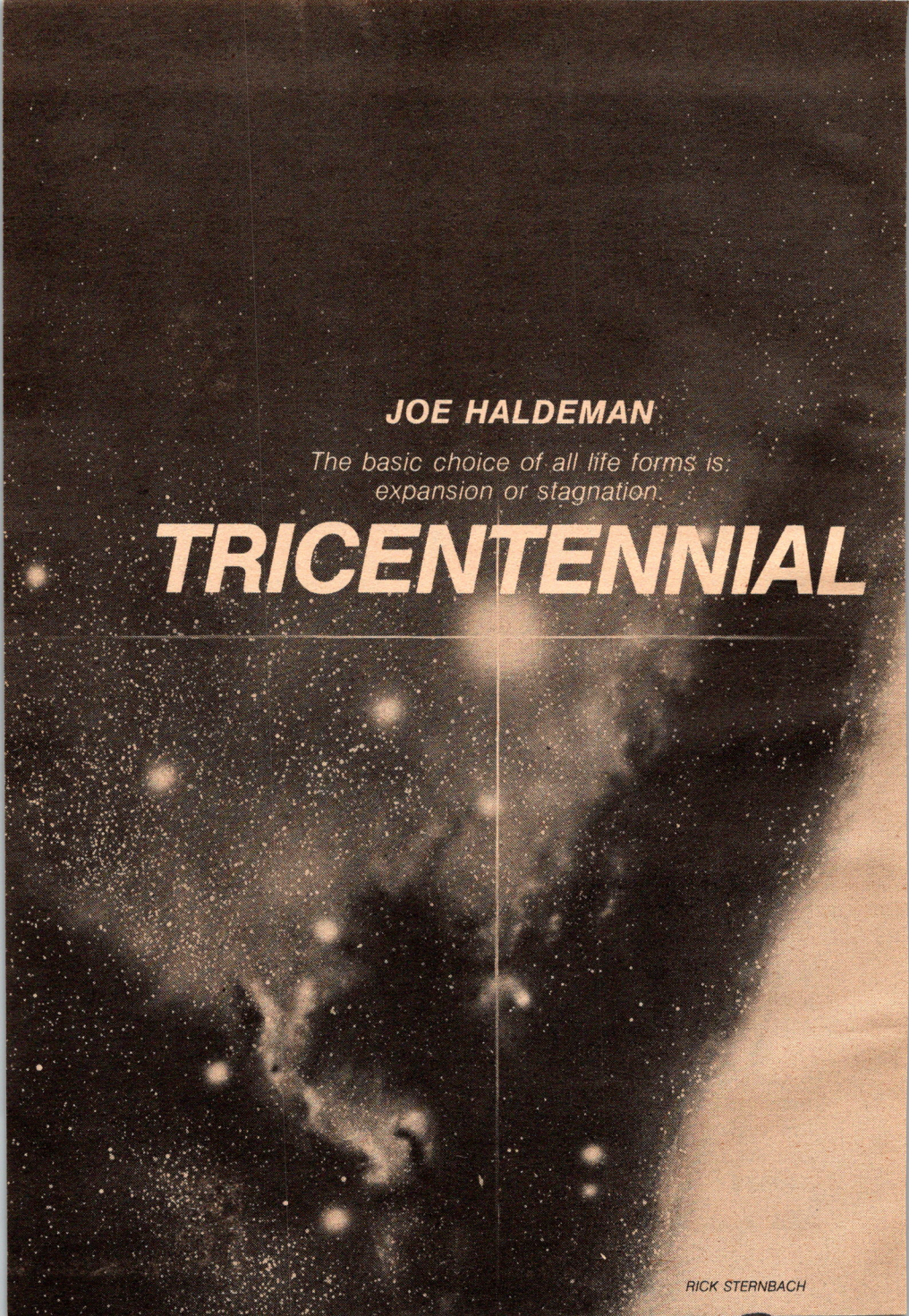
JOE HALDEMAN
The basic choice of all life forms is: expansion or stagnation.
TRICENTENNIAL
RICK STERNBACH

December 1975

Scientists pointed out that the Sun could be part of a double star system. For its companion to have gone undetected, of course, it would have to be small and dim, and thousands of astronomical units distant.

They would find it eventually; "it" would turn out to be "them"; they would come in handy.

January 2075

The office was opulent even by the extravagant standards of 21st century Washington. Senator Connors had a passion for antiques. One wall was lined with leatherbound books; a large brass telescope symbolized his role as Liaison to the Science Guild. An intricately woven Navajo rug from his home state covered most of the parquet floor. A grandfather clock. Paintings, old maps.

The computer terminal was discreetly hidden in the top drawer of his heavy teak desk. On the desk: a blotter, a precisely centered fountain pen set, and a century-old sound-only black Bell telephone. It chimed.

His secretary said that Dr. Leventhal was waiting to see him. "Keep answering me for thirty seconds," the Senator said. "Then hang it and send him right in."

He cradled the phone and went to a wall mirror. Straightened his tie and cape; then with a fingernail evened out the bottom line of his lip pomade. Ran a hand through long, thinning white hair and returned to stand by the desk, one hand on the phone.

The heavy door whispered open. A short thin man bowed slightly. "Sire."

The Senator crossed to him with both hands out. "Oh, blow that, Charlie. Give ten." The man took both his hands, only for an instant. "When was I ever 'Sire' to you, heyfool?"

"Since last week," Leventhal said, "Guild members have been calling you worse names than 'Sire.' "

The Senator bobbed his head twice. "True, and true. And I sympathize. Will of the people, though."

"Sure." Leventhal pronounced it as one word: "Willathapeeble."

Connors went to the bookcase and opened a chased panel. "Drink?"

"Yeah, Bo." Charlie sighed and lowered himself into a deep sofa. "Hit me. Sherry or something."

The Senator brought the drinks and sat down beside Charlie. "You shoulda listened to me. Shoulda got the Ad Guild to write your proposal."

"We have good writers."

"Begging to differ. Less than two percent of the electorate bothered to vote; most of them for the administration advocate. Now you take the Engineering Guild—"

"*You* take the engineers. And—"

"They used the Ad Guild." Connors shrugged. "They got their budget."

"It's easy to sell bridges and power plants and shuttles. Hard to sell pure science."

"The more reason for you to—"

"Yeah, sure. Ask for double and give half to the Ad boys. Maybe next year. That's not what I came to talk about."

"That radio stuff?"

"Right. Did you read the report?"

Connors looked into his glass. "Charlie, you know I don't have time to—"

"Somebody read it, though."

"Oh, righty-o. Good astronomy boy on my staff; he gave me a boil-down. Mighty interesting, that."

"There's an intelligent civilization eleven light-years away—that's 'mighty interesting'?"

"Sure. Real breakthrough." Uncomfortable silence. "Uh, what are you going to do about it?"

"Two things. First, we're trying to figure out what they're saying. That's hard. Second, we want to send a message back. That's easy. And that's where you come in."

The Senator nodded and looked somewhat wary.

"Let me explain. We've sent messages to this star, 61 Cygni, before. It's a double star, actually, with a dark companion."

"Like us."

"Sort of. Anyhow, they never answered. They aren't listening, evidently; they aren't sending."

"But we got—"

"What we're picking up is about what you'd pick up eleven light-years from Earth. A confused jumble of broadcasts, eleven years old. Very faint. But obviously not generated by any sort of natural source."

"Then we're already sending a message back. The same kind they're sending us."

"That's right, but—"

"So what does all this have to do with me?"

"Bo, we don't want to whisper at them—we want to *shout!* Get their attention." Leventhal sipped his wine and leaned back. "For that, we'll need one hell of a lot of power."

"Uh, righty-o. Charlie, power's money. How much are you talking about?"

"The whole show. I want to shut down Death Valley for twelve hours."

The Senator's mouth made a silent O. "Charlie, you've been working too hard. Another Blackout? On purpose?"

"There won't be any Blackout. Death Valley has emergency storage for fourteen hours."

"At half capacity." He drained his glass and walked back to the bar, shaking his head. "First you say you want power. Then you say you want to turn off the power." He came back with the burlap-cov-

ered bottle. "You aren't making sense, boy."

"Not turn it off, really. Turn it around."

"Is that a riddle?"

"No, look. You know the power doesn't really come from the Death Valley grid; it's just a way station and accumulator. Power comes from the orbital—"

"I know all that, Charlie. I've got a Science Certificate."

"Sure. So what we've got is a big microwave laser in orbit, that shoots down a tight beam of power. Enough to keep North America running. Enough—"

"That's what I mean. You can't just—"

"So we turn it around and shoot it at a power grid on the Moon. Relay the power around to the big radio dish at Farside. Turn it into radio waves and point it at 61 Cygni. Give 'em a blast that'll fry their fillings."

"Doesn't sound neighborly."

"It wouldn't actually be that powerful—but it would be a hell of a lot more powerful than any natural 21-centimeter source."

"I don't know, boy." He rubbed his eyes and grimaced. "I could maybe do it on the sly, only tell a few people what's on. But that'd only work for a few minutes . . . what do you need twelve hours for, anyway?"

"Well, the thing won't aim itself at the Moon automatically, the way it does at Death Valley. Figure as much as an hour to get the thing turned around and aimed.

"Then, we don't want to just send a blast of radio waves at them. We've got a five-hour program, that first builds up a mutual language, then tells them about us, and finally asks them some questions. We want to send it twice."

Connors refilled both glasses. "How old were you in '47, Charlie?"

"I was born in '45."

"You don't remember the Blackout. Ten thousand people died . . . and you want me to suggest—"

"Come on, Bo, it's not the same thing. We know the accumulators work now—besides, the ones who died, most of them had faulty fail-safes on their cars. If we warn them the power's going to drop, they'll check their fail-safes or damn well stay out of the air."

"And the media? They'd have to take turns broadcasting. Are you going to tell the People what they can watch?"

"Fuzz the media. They'll be getting the biggest story since the Crucifixion."

"Maybe." Connors took a cigarette and pushed the box toward Charlie. "You don't remember what happened to the Senators from California in '47, do you?"

"Nothing good, I suppose."

"No, indeed. They were impeached. Lucky they weren't lynched. Even though the real trouble was 'way up in orbit.

"Like you say: people pay a grid tax to California. They think the power comes from California. If something fuzzes up, they get pissed at California. I'm the Lib Senator from California, Charlie; ask me for the Moon, maybe I can do something. Don't ask me to fuzz around with Death Valley."

"All right, all right. It's not like I was asking you to wire it for me, Bo. Just get it on the ballot. We'll do everything we can to educate—"

"Won't work. You barely got the Scylla probe voted in—and that was no skin off nobody, not with L-5 picking up the tab."

"Just get it on the ballot."

"We'll see. I've got a quota, you know that. And the Tricentennial coming up, hell, everybody wants on the ballot."

"Please, Bo. This is bigger than that. This is bigger than anything. Get it on the ballot."

"Maybe as a rider. No promises."

March 1992

From *Fax & Pix*, 12 March 1992:

ANTIQUE SPACEPROBE ZAPPED BY NEW STARS

1. Pioneer 10 sent first Jupiter pix Earthward in 1973 (see pix upleft, upright).

2. Left solar system 1987. First man-made thing to leave solar system.

3. Yesterday, reports NSA, Pioneer 10 begins AM to pick up heavy radiation. Gets more and more to max about 3 PM. Then goes back down. Radiation has to come from outside solar system.

4. NSA and Hawaii scientists say Pioneer 10 went through disk of synchrotron (sin•kro•tron) radiation that comes from two stars we didn't know about before.

A. The stars are small "black dwarfs."

B. They are going round each other once every 40 seconds, and take 350,000 years to go around the Sun.

C. One of the stars is made of *antimatter*. This is stuff that blows up if it touches real matter. What the Hawaii scientists saw was a dim circle of invisible (infrared) light, that blinks on and off every twenty seconds. This light comes from where the atmospheres of the two stars touch (see pic downleft).

D. The stars have a big magnetic field. Radiation comes from stuff spinning off the stars and trying to get through the field.

E. The stars are about 5000 times as far away from the Sun as we are. They sit at the wrong angle, compared to the rest of the solar system (see pic downright).

5. NSA says we aren't in any danger from the stars. They're too far away, and besides, nothing in the solar system ever goes through the radiation.

6. The woman who discovered the stars wants to call them Scylla (*skill*•a) and Charybdis (ku•*rib*•dus).

7. Scientists say they don't know where the hell those two stars came from. Everything else in the solar system makes sense.

February 2075

When the docking phase started, Charlie thought, that was when it was easy to tell the scientists from the baggage. The scientists were the ones who looked nervous.

Superficially, it seemed very tranquil—nothing like the bonehurting skinstretching acceleration when the shuttle lifted off. The glittering transparent cylinder of L-5 simply grew larger, slowly, then wheeled around to point at them.

The problem was that a space colony big enough to hold 4000 people has more inertia than God. If the shuttle hit the mating dimple too fast, it would fold up like an accordian. A space ship is made to take stress in the *other* direction.

Charlie hadn't paid first class, but they let him up into the observation dome anyhow; professional courtesy. There were only two other people there, standing on the Velcro rug, strapped to one bar and hanging on to another.

They were a young man and woman, probably new colonists. The man was talking excitedly. The woman stared straight ahead, not listening. Her knuckles were white on the bar and her teeth were clenched. Charlie wanted to say something in sympathy, but it's hard to talk while you're holding your breath.

The last few meters are the worst. You can't see over the curve of the ship's hull, and the steering jets make a constant stutter of little bumps: left, right, forward, back. If the shuttle folded, would the dome shatter? Or just pop off.

It was all controlled by computers, of course. The pilot just sat up there in a mist of weightless sweat.

Then the low moan, almost subsonic shuddering as the shuttle's smooth hull complained against the friction pads. Charlie waited for the ringing *spang* that would mean they were a little too fast: friable alloy plates under the friction pads, crumbling to absorb the energy of their forward motion; last-ditch stand.

If that didn't stop them, they would hit a two-meter wall of solid steel, which would. It had happened once. But not this time.

"Please remain seated until pressure is equalized," a recorded voice said. "It's been a pleasure having you aboard."

Charlie crawled down the pole, back to the passenger area. He walked rip,rip,rip back to his seat and obediently waited for his ears to pop. Then the side door opened and he went with the other passengers through the tube that led to the elevator. They stood on the ceiling. Someone had laboriously

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scratched a graffito on the metal wall:

Stuck on this lift for hours,
perforce:
This lift that cost a million bucks.
There's no such thing as
centrifugal force:
L-5 sucks.

Thirty more weightless seconds as they slid to the ground. There were a couple of dozen people waiting on the loading platform.

Charlie stepped out into the smell of orange blossoms and newly-mown grass. He was home.

"Charlie! Hey, over here." Young man standing by a tandem bicycle. Charlie squeezed both his hands and then jumped on the back seat. "Drink."

"Did you get—"

"Drink. Then talk." They glided down the smooth macadam road toward town.

The bar was just a rain canopy over some tables and chairs, overlooking the lake in the center of town. No bartender: you went to the service table and punched in your credit number, then chose wine or fruit juice; with or without vacuum-distilled raw alcohol. They talked about shuttle nerves awhile, then:

"What you get from Connors?"

"Words, not much. I'll give a full report at the meeting tonight. Looks like we won't even get on the ballot, though."

"Now isn't that what we said was going to happen? We shoulda gone with Francois Petain's idea."

"Too risky." Petain's plan had been to tell Death Valley they had to shut down the laser for repairs. Not tell the groundhogs about the signal at all, just answer it. "If they found out they'd sue us down to our teeth."

The man shook his head. "I'll never understand groundhogs."

"Not your job." Charlie was an Earth-born, Earth-trained psychologist. "Nobody born here ever could."

"Maybe so." He stood up. "Thanks for the drink; I've gotta get back to work. You know to call Dr. Bemis before the meeting?"

"Yeah. There was a message at the Cape."

"She has a surprise for you."

"Doesn't she always? You clowns never do anything around here until I leave."

All Abigail Bemis would say over the phone was that Charlie should come to her place for dinner; she'd prep him for the meeting.

"That was good, Ab. Can't afford real food on Earth."

She laughed and stacked the plates in the cleaner, then drew two cups of coffee. She laughed again when she sat down. Stocky, white-haired woman with bright eyes in a sea of wrinkles.

"You're in a jolly mood tonight."

"Yep. It's expectation."

"Johnny said you had a surprise."

"Hooboy, he doesn't know half. So you didn't get anywhere with the Senator."

"No. Even less than I expected. What's the secret?"

"Connors is a nice-hearted boy. He's done a lot for us."

"Come on, Ab. What is it?"

"He's right. Shut off the groundhogs' TV for twenty minutes and they'd have another Revolution on their hands."

"Ab . . ."

"We're going to send the message."

"Sure, I figured we would. Using Farside at whatever wattage we've got. If we're lucky—"

"Nope. Not enough power."

Charlie stirred a half-spoon of sugar into his coffee. "You plan to . . . defy Connors?"

"Fuzz Connors. We're not going to use radio at all."

"Visible light? Infra?"

"We're going to hand-carry it. In Daedalus."

Charlie's coffee cup was halfway to his mouth. He spilled a great deal.

"Here, have a napkin."

June 2040

From *A Short History Of the Old Order* (Freeman Press, 2040):

". . . and if you think *that* was a waste, consider Project Daedalus.

"This was the first big space thing after L-5. Now L-5 worked out all right, because it was practical. But Daedalus (named from a Greek god who could fly)—that was a clear-cut case of throwing money down the rat-hole.

"These scientists in 2016 talked the bourgeoisie into paying for a trip to another *star!* It was going to take over a hundred years—but the scientists were going to have babies along the way, and train *them* to be scientists (whether they wanted to or not!).

"They were going to use all the old H-bombs for fuel—as if we might not need the fuel some day right here on Earth. What if L-5 decided they didn't like us, and shut off the power beam?

"Daedalus was supposed to be a spaceship almost a kilometer long! Most of it was manufactured in space, from Moon stuff, but a lot of it—the most expensive part, you bet—had to be boosted from Earth.

"They almost got it built, but then came the Breakup and the People's Revolution. No way in hell the People were going to let them have those H-bombs, not sitting right over our heads like that.

"So we left the H-bombs in Helsinki and the space freeks went back to doing what they're supposed to do. Every year they petition to get those H-bombs, but every year the Will of the People says no.

"That space ship is still up there, a skytrillion dollar boondoggle. As

a monument to bourgeoisie folly, it's worse than the Pyramids!!"

February 2075

"So the Scylla probe is just a ruse, to get the fuel—"

"Oh no, not really." She slid a blue-covered folder to him. "We're still going to Scylla. Scoop up a few megatons of degenerate antimatter. And a similar amount of degenerate matter from Charybdis.

"We don't plan a generation ship, Charlie. The hydrogen fuel will get us out there; once there, it'll power the magnetic bottles to hold the real fuel."

"Total annihilation of matter," Charlie said.

"That's right. Em-cee-squared to the ninth decimal place. We aren't talking about centuries to get to 61 Cygni. Nine years, there and back."

"The groundhogs aren't going to like it. All the bad feeling about the original Daedalus—"

"Fuzz the groundhogs. We'll do everything we said we'd do with their precious H-bombs: go out to Scylla, get some antimatter, and bring it back. Just taking a long way back."

"You don't want to just tell them that's what we're going to do? No skin off . . ."

She shook her head and laughed again, this time a little bitterly. "You didn't read the editorial in *Peoplepost* this morning, did you?"

"I was too busy."

"So am I, boy; too busy for that drik. One of my staff brought it in, though."

"It's about Daedalus?"

"No . . . it concerns 61 Cygni. How the crazy scientists want to let those boogers know there's life on Earth."

"They'll come make people-burgers out of us."

"Something like that."

Over three thousand people sat on the hillside, a "natural" amphitheatre fashioned of moon dirt and Earth grass. There was an incredible din, everyone talking at once: Dr. Bemis had just told them about the 61 Cygni expedition.

On about the tenth "Quiet, please," Bemis was able to continue. "So you can see why we didn't simply broadcast this meeting. Earth would pick it up. Likewise, there are no groundhog media on L-5 right now. They were rotated back to Earth and the shuttle with their replacements needed repairs at the Cape. The other two shuttles are here.

"So I'm asking all of you—and all of your brethren who had to stay at their jobs—to keep secret the biggest thing since Isabella hocked her jewels. Until we lift.

"Now Dr. Leventhal, who's chief of our social sciences section, wants to talk to you about selecting the crew."

Charlie hated public speaking. In this setting, he felt like a Christian on the way to being catfood. He

smoothed out his damp notes on the podium.

"Uh, basic problem." A thousand people asked him to speak up. He adjusted the microphone.

"The basic problem is, we have space for about a thousand people. Probably more than one out of four want to go."

Loud murmur of assent. "And we don't want to be despotic about choosing . . . but I've set up certain guidelines, and Dr. Bemis agrees with them.

"Nobody should plan on going if he or she needs sophisticated medical care, obviously. Same toke, few very old people will be considered."

Almost inaudibly, Abigail said, "Sixty-four isn't very old, Charlie. I'm going." She hadn't said anything earlier.

He continued, looking at Bemis. "Second, we must leave behind those people who are absolutely necessary for the maintenance of L-5. Including the power station." She smiled at him.

"We don't want to split up mating pairs, not for, well, nine years plus . . . but neither will we take children." He waited for the commotion to die down. "On this mission, children are baggage. You'll have to find foster parents for them. Maybe they'll go on the next trip.

"Because we can't afford baggage. We don't know what's waiting for us at 61 Cygni—a thousand people sounds like a lot, but it isn't. Not when you consider that we need a cross-section of all human knowledge, all human abilities. It may turn out that a person who can sing madrigals will be more important than a plasma physicist. No way of knowing ahead of time."

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The 4,000 people did manage to keep it secret, not so much out of strength of character as from a deep-seated paranoia about Earth and Earthlings.

And Senator Connors' Tricentennial actually came to their aid.

Although there was "One World," ruled by "The Will of the People," some regions had more

clout than others, and nationalism was by no means dead. This was one factor.

Another factor was the way the groundhogs felt about the thermonuclear bombs stockpiled in Helsinki. All antiques; mostly a century or more old. The scientists said they were perfectly safe, but you know how that goes.

The bombs still technically belonged to the countries that had surrendered them, nine out of ten split between North America and Russia. The tenth remaining was divided among 42 other countries. They all got together every few years to argue about what to do with the damned things. Everybody wanted to get rid of them in some useful way, but nobody wanted to put up the capital.

Charlie Leventhal's proposal was simple. L-5 would provide bankroll, materials, and personnel. On a barren rock in the Norwegian Sea they would take apart the old bombs, one at a time, and turn them into uniform fuel capsules for the Daedalus craft.

The Scylla/Charybdis probe would be timed to honor both the major spacefaring countries. Renamed the *John F. Kennedy*, it would leave Earth orbit on America's Tricentennial. The craft would accelerate halfway to the double star system at one gee, then flip and slow down at the same rate. It would use a magnetic scoop to gather antimatter from Scylla. On May Day, 2077, it would again be renamed, being the *Leonid I. Brezhnev* for the return trip. For safety's sake, the antimatter would be delivered to a lunar research station, near Farside. L-5 scientists claimed that harnessing the energy from total annihilation of matter would make a heaven on Earth.

Most people doubted that, but looked forward to the fireworks.

January 2076

"The *hell* with that!" Charlie was livid. "I—I just won't do it. Won't!"

"You're the only one—"

"That's not true, Ab, you know it." Charlie paced from wall to wall of her office cubicle. "There are dozens of people who can run L-5. Better than I can."

"Not better, Charlie."

He stopped in front of her desk, leaned over. "Come on, Ab. There's only one logical person to stay behind and run things. Not only has she proven herself in the position, but she's too old to—"

"That kind of drik I don't have to listen to."

"Now, Ab . . ."

"No, you listen to me. I was an infant when we started building Daedalus; worked on it as a girl and a young woman.

"I could take you out there in a shuttle and show you the rivets that I put in, myself. A half-century ago."

"That's my—"

"I earned my ticket, Charlie."

Her voice softened. "Age is a factor, yes. This is only the first trip of many—and when it comes back, I *will* be too old. You'll just be in your prime . . . and with over twenty years of experience as Coordinator, I don't doubt they'll make you captain of the next—"

"I don't want to be captain. I don't want to be Coordinator. I just want to *go*!"

"You and three thousand other people."

"And of the thousand that don't want to go, or can't, there isn't one person who could serve as Coordinator? I could name you—"

"That's not the point. There's no one on L-5 who has anywhere near the influence, the connections, you have on Earth. No one who understands groundhogs as well."

"That's racism, Ab. Groundhogs are just like you and me."

"Some of them. I don't see you going Earthside every chance you can get . . . what, you like the view up here? You like living in a can?"

He didn't have a ready answer for that. Ab continued: "Whoever's Coordinator is going to have to do some tall explaining, trying to keep things smooth between L-5 and Earth. That's been your life's work, Charlie. And you're also known and respected here. You're the only logical choice."

"I'm not arguing with your logic."

"I know." Neither of them had to mention the document, signed by Charlie, among others, that gave Dr. Bemis final authority in selecting the crew for Daedalus/Kennedy/Brezhnev. "Try not to hate me too much, Charlie. I have to do what's best for my people. All of my people."

Charlie glared at her for a long moment and left.

June 2076

From *Fax & Pix*, 4 June 2076:

SPACE FARM LEAVES FOR STARS NEXT MONTH

1. The *John F. Kennedy*, that goes to Scylla/Charybdis next month, is like a little L-5 with bombs up its tail (see pix upleft, upright).

A. The trip's twenty months. They could either take a few people and fill the thing up with food, air, and water—or take a lot of people inside a closed ecology, like L-5.

B. They could've gotten by with only a couple hundred people, to run the farms and stuff. But almost all the space freeks wanted to go. They're used to living that way, anyhow (and they never get to go anyplace).

C. When they get back, the farms will be used as a starter for L-4, like L-5 but smaller at first, and on the other side of the Moon (pic downleft).

2. For other Tricentennial fax & pix, see bacover.

July 2076

Charlie was just finishing up a week on Earth the day the *John F. Kennedy* was launched. Tired of being interviewed, he slipped away from the media lounge at the Cape shuttleport. His white clearance card got him out onto the landing strip, alone.

The midnight shuttle was being fueled at the far end of the strip, gleaming pink-white in the last light from the setting sun. Its image twisted and danced in the shimmering heat that radiated from the tarmac. The smell of the soft tar was indelibly associated in his mind with leave-taking, relief.

He walked to the middle of the strip and checked his watch. Five minutes. He lit a cigarette and threw it away. He rechecked his mental calculations: the flight would start low in the southwest. He blocked out the sun with a raised hand. What would 150 bombs per second look like? For the media they were called fuel capsules. The people who had carefully assembled them and gently lifted them to orbit and installed them in the tanks, they called them bombs. Ten times the brightness of a full moon, they had said. On L-5 you weren't supposed to look toward it without a dark filter.

No warm-up: it suddenly appeared, impossibly brilliant rainbow speck just over the horizon. It gleamed for several minutes, then dimmed slightly with the haze, and slipped away.

Most of the United States wouldn't see it until it came around again, some two hours later, turning night into day, competing with local pyrotechnic displays. Then every couple of hours after that, Charlie would see it once more, then get on the shuttle. And finally stop having to call it by the name of a dead politician.

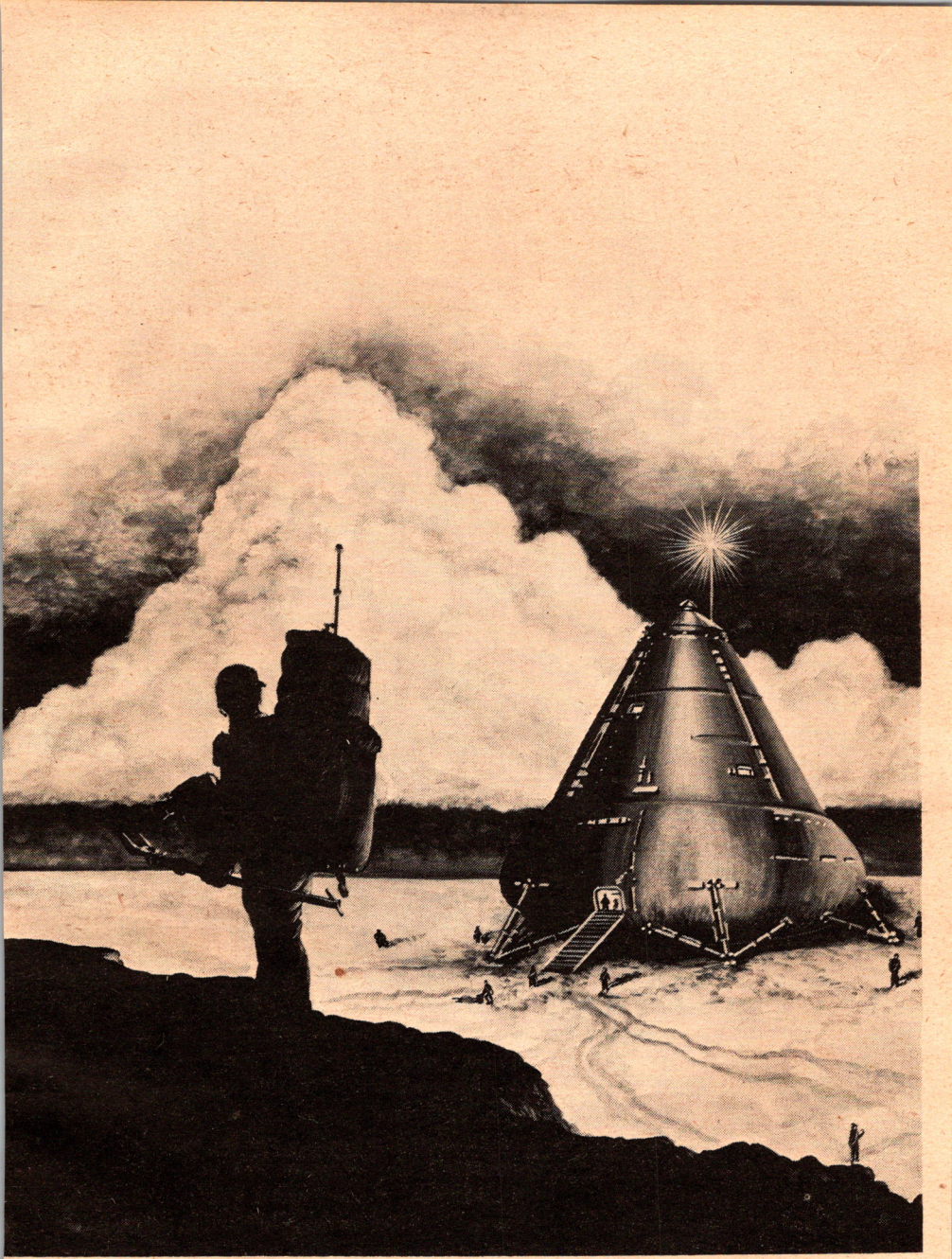
September 2076

There was a quiet celebration on L-5 when *Daedalus* reached the mid-point of its journey, flipped, and started decelerating. The progress report from its crew characterized the journey as "uneventful." At that time they were going nearly two tenths of the speed of light. The laser beam that carried communications was red-shifted from blue light down to orange; the message that turnaround had been successful took two weeks to travel from *Daedalus* to L-5.

They announced a slight course change. They had analyzed the polarization of light from Scylla/Charybdis as their phase angle increased, and were pretty sure the system was surrounded by flat rings of debris, like Saturn. They would "come in low" to avoid collision.

January 2077

Daedalus had been sending back



recognizable pictures of the Scylla/Charybdis system for three weeks. They finally had one that was dramatic enough for groundhog consumption.

Charlie set the holo cube on his desk and pushed it around with his finger, marvelling.

"This is incredible. How did they do it?"

"It's a montage, of course." Johnny had been one of the youngest adults left behind: heart murmur, trick knees, a surfeit of astrophysicists.

"The two stars are a strobe snapshot in infrared. Sort of. Some ten or twenty thousand exposures taken as the ship orbited around the system, then sorted out and enhanced." He pointed, but it wasn't much help, since Charlie was looking at the cube from a different angle.

"The lamina of fire where the atmospheres touch, that was taken in ultraviolet. Shows more fine structure that way.

"The rings were easy. Fairly long exposures in visible light. Gives the star background, too."

A light tap on the door and an assistant stuck his head in. "Have a second, Doctor?"

"Sure."

"Somebody from a Russian May Day committee is on the phone. She wants to know whether they've changed the name of the ship to *Brezhnev* yet."

"Yeah. Tell her we decided on 'Leon Trotsky' instead, though."

He nodded seriously. "Okay." He started to close the door.

"*Wait!*" Charlie rubbed his eyes. "Tell her, uh . . . the ship doesn't have a commemorative name while it's in orbit there. They'll rechristen it just before the start of the return trip."

"Is that true?" Johnny asked.

"I don't know. Who cares? In another couple of months they won't *want* it named after anybody." He and Ab had worked out a plan—admittedly rather shaky—to protect L-5 from the groundhogs' wrath: nobody on the satellite knew ahead of time that the ship was headed for 61 Cygni. It was a decision the crew arrived at on the way to Scylla/Charybdis; they modified the drive system to accept matter-antimatter destruction while they were orbiting the double star. L-5 would first hear of the mutinous plan via a transmission sent as *Daedalus* left Scylla/Charybdis. They'd be a month on their way by the time the message got to Earth.

It was pretty transparent, but at least they had been careful that no record of *Daedalus*' true mission be left on L-5. Three thousand people did know the truth, though, and any competent engineer or physical scientist would suspect it.

Ab had felt that, although there was a better than even chance they would be exposed, surely the groundhogs couldn't stay angry for 23 years—even if they were unim-

pressed by the antimatter and other wonders . . .

Besides, Charlie thought, it's not their worry anymore.

As it turned out, the crew of *Daedalus* would have bigger things to worry about.

June 2077

The Russians had their May Day celebration—Charlie watched it on TV and winced every time they mentioned the good ship *Leonid I. Brezhnev*—and then things settled back down to normal. Charlie and three thousand others waited nervously for the "surprise" message. It came in early June, as expected, scrambled in a data channel. But it didn't say what it was supposed to:

"This is Abigail Bemis, to Charles Leventhal.

Charlie, we have real trouble. The ship has been damaged, hit in the stern by a good chunk of something. It punched right through the main drive reflector. Destroyed a set of control sensors and one attitude jet.

As far as we can tell, the situation is stable. We're maintaining acceleration at just a tiny fraction under one gee. But we can't steer, and we can't shut off the main drive.

We didn't have any trouble with ring debris when we were orbiting, since we were inside Roche's limit. Coming in, as you know, we'd managed to take advantage of natural divisions in the rings. We tried the same going back, but it was a slower, more complicated process, since we mass so goddamn much now. We must have picked up a piece from the fringe of one of the outer rings.

If we could turn off the drive, we might have a chance at fixing it. But the work pods can't keep up with the ship, not at one gee. The radiation down there would fry the operator in seconds, anyway.

We're working on it. If you have any ideas, let us know. It occurs to me that this puts you in the clear—we were *headed back to Earth, but got clobbered. Will send a transmission to that effect on the regular comm channel. This message is strictly burn-before-reading.*

Endit.

It worked perfectly, as far as getting Charlie and L-5 off the hook—and the drama of the situation precipitated a level of interest in space travel unheard-of since the 1960's.

They even had a hero. A volunteer had gone down in a heavily-shielded work pod, lowered on a cable, to take a look at the situation. She'd sent back clear pictures of the damage, before the cable snapped.

***Daedalus:* A.D. 2081**
Earth: A.D. 2101

The following news item was killed

from *Fax & Pix*, because it was too hard to translate into the "plain English" that made the paper so popular:

SPACESHIP PASSES 61 CYGNI–SORT OF

(L-5 Stringer)

A message received today from the spaceship *Daedalus* said that it had just passed within 400 astronomical units of 61 Cygni. That's about ten times as far as the planet Pluto is from the Sun.

Actually, the spaceship passed the star some eleven years ago. It's taken all that time for the message to get back to us.

We don't know for sure where the spaceship actually is, now. If they still haven't repaired the runaway drive, they're about eleven light-years past the 61 Cygni system (their speed when they passed the double star was better than 99% the speed of light).

The situation is more complicated if you look at it from the point of view of a passenger on the spaceship. Because of relativity, time seems to pass more slowly as you approach the speed of light. So only about four years passed for them, on the eleven light-year journey.

L-5 Coordinator Charles Leventhal points out that the spaceship has enough antimatter fuel to keep accelerating to the edge of the Galaxy. The crew then would be only some twenty years older—but it would be twenty *thousand* years before we heard from them. . . .

(Kill this one. There's more stuff about what the ship looked like to the people on 61 Cygni, and howcum we could talk to them all the time even though time was slower there, but its all as stupid as this.)

***Daedalus:* A.D. 2083**
Earth: A.D. 2144

Charlie Leventhal died at the age of 99, bitter. Almost a decade earlier it had been revealed that they'd planned all along for *Daedalus* to be a starship. Few people had paid much attention to the news. Among those who did, the consensus was that anything that got rid of a thousand scientists at once, was a good thing. Look at the mess they got us in.

Daedalus: 67 light-years out, and still accelerating.

***Daedalus:* A.D. 2085**
Earth: A.D. 3578

After over seven years of shipboard research and development—and some 1500 light-years of travel—they managed to shut down the engine. With sophisticated telemetry, the job was done without endangering another life.

Every life was precious now. They were no longer simply explorers; almost half their fuel was gone. They were colonists, with no ticket back.

The message of their success would reach Earth in fifteen centuries. Whether there would be an infrared telescope around to detect

it, that was a matter of some conjecture.

***Daedalus:* A.D. 2093**
Earth: ca. A.D. 5000

While decelerating, they had investigated several systems in their line of flight. They found one with an Earth-type planet around a Sun-type sun, and aimed for it.

The season they began landing colonists, the dominant feature in the planet's night sky was a beautiful blooming cloud of gas that astronomers had named the North American Nebula.

Which was an irony that didn't occur to any of these colonists from L-5—give or take a few years, it was America's Trimillenial.

America itself was a little the worse for wear, this three thousandth anniversary. The seas that lapped its shores were heavy with a crimson crust of anaerobic life; the mighty cities had fallen and their remains, nearly ground away by the never-ceasing sandstorms.

No fireworks were planned, for lack of an audience, for lack of planners; bacteria just don't care. May Day too would be ignored.

The only humans in the Solar System lived in a glass and metal tube. They tended their automatic machinery, and turned their backs on the dead Earth, and worshiped the constellation Cygnus, and had forgotten why. ■

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SPACE COLONIZATION NOW: VISION AND REALITY

The argument over building colonies in space is no longer about the technical feasibility of the concept. The argument now centers on When? How much? and Why?

NORMAN SPINRAD

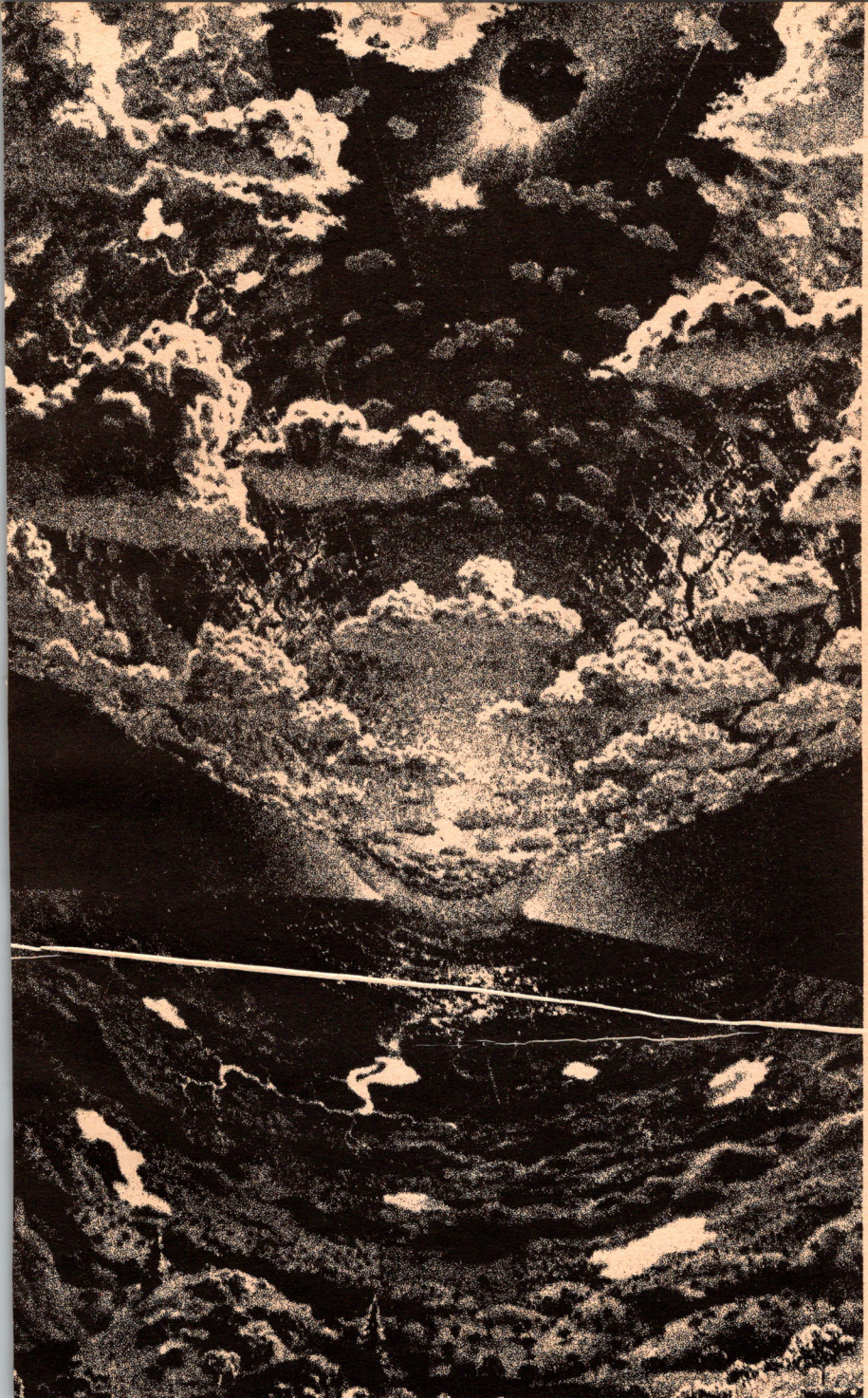
At a time of economic recession, reduced NASA budgets, a long hiatus in the manned space program, and diminished public interest in space activities, Dr. Gerard O'Neill of Princeton University has gone against the prevailing winds of public policy and apparent economic reality to propose a space project of such scope, expense, and vision that if carried out would represent a quantum jump into science fiction writers' version of the 22nd century. And not in some distant yonder, but by the year 2000. Moreover, he proposes that the project be begun *now*, with what he claims is more or less currently available space technology.

What O'Neill proposes is that we build a self-contained space colony housing some 10,000 people at Earth-Moon Lagrange point L-5, a stable position equidistant from Earth and Moon. The colony would be constructed using lunar rock as the basic raw material, and it would use this same raw material to build a system of space-borne solar power satellites which would supply electric power to the Earth through microwave transmitters and Earthside antenna arrays. Total capital investment: $130-200 billion.

The L-5 Space Colony project would consist of seven basic installations and logistics systems, each essential to the whole:

(1) A combination of Space Shuttles and Heavy Lift Vehicles

A completely terrestrial environment, from rotation-induced gravity to blue, cloud-flecked skies, is available in the miles-long L-5 orbital colony.



developed from Saturn V and Shuttle technology to put 2000 workers and thousands of tons of material into Earth orbit.

(2) A so-called "Construction Shack" built by these space workers from the material boosted from Earth into orbit—a space station which, upon completion, would be moved to Lagrange point 5, where it would be used as a habitat and "machine shop" to construct the actual L-5 colony.

(3) A permanent mining installation on the Moon with a "transport linear accelerator," a kind of super rock-thrower, which would propel lunar ores off the surface of the Moon and out of its gravity well using on-site solar or nuclear power to generate the necessary energy.

(4) A "Catcher" at some point between the Moon and the L-5 point which would collect the lunar material launched into space by the accelerator and which would also have facilities for transferring it to the colony construction site.

(5) The actual 10,000 person L-5 colony itself.

(6) Solar power generators and microwave transmitters in geosynchronous Earth orbit, which would generate electricity from sunlight, convert it into microwave energy, and beam it to the Earth.

(7) Earthside antenna arrays for collecting the microwave energy and converting it to electricity.

Although a project of this magnitude, cost, and complexity may seem more like airy speculation than a hard programmatic proposal, taken in one indigestible lump, it has already accumulated considerable solidity and credibility. An "L-5 Society" exists, which publishes a newsletter and acts as a political lobby with NASA and Congress. The proposal has been endorsed by a long list of prominent names, mostly scientists, but including Morris K. Udall, an announced Democratic Presidential candidate. Dr. O'Neill himself has testified before the House Space Science and Applications Subcommittee, to favorable response. NASA is seriously studying the L-5 proposals, in whole, and in part. The L-5 proposal seems on the verge of becoming a subject of serious political debate.

O'Neill and others have prepared papers on every aspect of the total project, from building a transport linear accelerator to eliminating billy goat stink from goat milk in order to make it palatable to the colonists as a substitute for less feed-efficient bovine dairy products. So the total program can be evaluated as to cost, feasibility, timeframe, ultimate desirability, and to some extent environmental impact. Can it be done? Should it be done? Is it affordable? If the answers to all these questions are not unequivocably yes, how much of it can be done, should be done, and can be afforded?

Before these questions can be an-

swered for the L-5 project as a whole, they must be answered in relation to the seven constituent installations and logistics systems.

The Earth-to-Earth-orbit logistical systems proposed seem to offer no serious obstacles to the total project except perhaps one of cost, given current political and economic realities. The Space Shuttle itself will be available in the 1980s anyway, with its development costs already budgeted under other programs. However, the Shuttle that NASA is now building would in itself be incapable of boosting the necessary mass to build the Construction Shack and the Lunar installation into Earth orbit at anything like an affordable cost. Therefore two additional developments are being proposed to bring the cost of boosting huge masses into Earth orbit into the realm of the economically possible.

First, a so-called Heavy Lift Launch Vehicle could be more or less knocked together using four solid fuel boosters as the first stage and recoverable Shuttle engines and avionics as the second stage. According to the perhaps optimistic estimate of Dr. T.A. Heppenheimer of the L-5 group, this would give the project a vehicle which could boost 300,000 lbs. into orbit at a cost of $20 million per launch, after a mere $500 million capital outlay for research and development. It is generally estimated by the L-5 people that it will be necessary to boost perhaps 10,000 tons a year into Earth orbit before the Lunar installation is completed, giving an annual freight bill alone of $1 billion, or better than a quarter of the current total NASA budget. The assumption that this vehicle could be developed for $500 million seems almost as dubious as the assumption that an annual freight bill of $1 billion could be pushed through Congress.

The second proposed vehicle, though initially much more expensive to develop, seems much more within the realm of political and economic reality. What is proposed here is to go back to the original Space Shuttle concept and build the component that was cut out of the current program for considerations of short-term economy: a winged, manned, recoverable first stage for the Space Shuttle based on the Saturn V first stage booster. It is estimated that it would take $5 billion to develop, but it could place 400,000 lbs. in orbit at a cost of $10 million, and would reduce the freight bill to something under $500 million a year, a figure more in line with political realities. Further, the Flyback first stage would reduce the costs of *all* Shuttle missions, so its development cost could reasonably be amortized out over the total space budget, not just the L-5 program. This, after all, was what the Space Shuttle program was supposed to look like before

the meat-ax was applied to the NASA budget.

The L-5 people favor going with the Heavy Lift Vehicle initially because the Flyback Shuttle first stage might take seven years to develop and they want to get started *now*. But that seems to be as much a matter of going off half-cocked as the decision to build the Shuttle without the Flyback first stage was a matter of penny-wise and pound-foolish.

To sum up, a realistic orbital logistics system could be had in seven years at a development cost of $5 billion or considerably less than $1 billion a year. It could put 10,000 tons a year into orbit at a cost of less than $500 million a year thereafter. Not exactly a cut-rate program, but since its annual cost would never have to exceed $750 million, one which could be presented to Congress with a straight face and some real hope of initial passage and continued funding. Total cost: something like $8 billion over 12 years, which at least sounds feasible.

Given this Earth orbit logistics system, building the 2000 man "Construction Shack" presents no serious technological or economic difficulties. Gerald Driggers of Southern Research Institute has designed a proposed construction shack and there are many other available designs for Permanent Manned Space Stations of this size. The PMSS would most likely be a torus rotating about its center to provide artificial gravity. Hydroponic agriculture would provide most if not all of the food for the crew and would recycle oxygen through the plant-animal cycle. Energy would be provided by the same sort of solar mirror system as proposed for the L-5 colony, greatly scaled down. This sort of space station has been contemplated so long by so many people that designing it is strictly a civil engineering problem. Moreover, there have been NASA studies showing how such a space station could be quickly put together using empty Saturn V upper stages as modules. With an advanced Shuttle system, such a PMSS is virtually an inevitability anyway. Total cost: hard to estimate, but probably less than the cost of building the World Trade Center in New York, once the freight charges are discounted.

But when we get to the next stage, the permanent Lunar station and transport linear accelerator, we are no longer quite in the realm of available technology. Given an Earth-orbit PMSS, transporting the necessary mass to the Moon is relatively cheap and easy. Rather flimsy and inexpensive Earth-orbit-Lunar-orbit shuttles can be assembled in Earth orbit and could transfer the materials to Lunar orbit slowly, but with relatively minimal energy requirements, using banks of ion thrusters already designed by

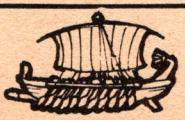
NASA. Soft-landing men and material on the Moon will require more expensive conventional rocket motors, but this will not be prohibitive, given the light lunar gravity.

With an established PMSS in Earth orbit, building and maintaining a 100-man Lunar base would be the next logical step in any rational space program, and the additional cost would be well within the realm of reason. However, the transport linear accelerator, the essential key to building the actual L-5 colony, is something else again.

The TLS *is* the entire rationale for building the 10,000 man L-5 colony. An eleven kilometer straight monorail track would be constructed on the surface of the Moon. "Buckets" would be filled with lunar ores and electromagnetically suspended on this track. They would be accelerated along the track electromagnetically. At the end of the track, the motion of the buckets is arrested, and the momentum thereby transferred to the contents, which soar up and out of the Moon's gravitational well. A sophisticated hybrid of an ore conveyor system and an ancient catapult.

The electricity to power the system would be generated by on-site solar or nuclear installations. Only actual payload will have to be lifted from the Moon, and since the Moon's gravity is 1/6 that of the Earth, it will take only 1/6 the energy to move the ores from its surface, compared with using the Earth as the raw material supply for building the large colony. This is *the* reason for building the colony at L-5 instead of Earth orbit. In fact, since the costs of orbiting such immense mass from the Earth would be gargantuan, it is the TLS which would make the whole project feasible at all, at least in its present, somewhat grandiose form.

But just how feasible is the TLS itself? The device would operate using known and well-understood principles, but nothing really like it has ever been built, since it will only work in relative vacuum and relatively low gravity. Assuming



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that lunar ores smelted on-site could be used to build it, the cost, though something rather imponderable, might be reasonable or at least within the realm of the possible, and the necessary power can be generated. No doubt a Lunar TLS can be built that will be able to boost the requisite ores off the surface of the Moon.

However, and a big however it is, this super-catapult is going to have to be diabolically accurate. All it has to do is intercept the "Catcher", 35,000 miles away at the translunar libration point (as close a stable intercept point as can be maintained) accurately to within 100 meters, or an allowable error of .00017%!

For the projected "Catcher" is simply a large cone-shaped plastic bag with a mouth 100 meters in diameter, guarded by a grid of cables across it to protect the bag by breaking up chunks of lunar rock that are too massive. It is a passive target which must be hit with preternatural accuracy. A practical non-passive Catcher has not yet been designed by the L-5 advocates.

Once the Catcher is filled with ore (assuming that this is possible), it is slowly and cheaply transferred to the L-5 point by ion thrusters like a big blimp while another giant plastic bag takes its place and is *very carefully and accurately aligned*, one would hope.

This TLS-Catcher system passes over the line from modified existing technology into something suspiciously like Rube Goldbergland. Thusfar, it is the weakest link in the whole L-5 colony proposal, and, unfortunately, it is a key element in the whole scheme. If it does not work, the L-5 colony cannot be built. It would cost billions of dollars to construct and would require a permanent Lunar base with massive mining capacity and power output to support it, and it would be impossible to test it on a smaller scale on Earth beforehand. Can the TLS be aligned accurately enough to hit a 100 meter target at 35,000 miles? Can the Catchers be kept on station accurately enough and consistently enough to make the system work, even assuming that the catapult can achieve accuracy to .00017%? Would you bet scores of billions of dollars that the answers to both these questions will be yes?

Just as the weakest and most questionable link in the series of logistics systems needed to build the L-5 colony is the one key element which would make it physically and economically possible, the reason given by O'Neill for wanting to build it in the first place also involves a logistics system based on some rather dicey suppositions.

As given by O'Neill, the practical economic reason for building the L-5 colony in the first place is to supply cheap, inexhaustible, environmentally benign electrical power

to the Earth, that is, to create an "ideal energy source." (See my article, ENERGY AND SURVIVAL: THE FORK IN THE ROAD, Analog, July 1975.) To do this, very large mirrors (kilometers in diameter) would be built in space from lunar material near the colony and then transferred by ion thrusters to geosynchronous Earth orbit, to convert sunlight into electricity. Such solar generators have been built on a much smaller scale on Earth, and since these huge mirrors would be built in airless, frictionless, zero-gravity space, they could be relatively flimsy structures built at relatively low costs. There is no serious doubt that this could be done, and done relatively cheaply, given that the rest of the total system is feasible.

However, this space-generated electrical power must be transmitted to the surface of the Earth, and it is here that we encounter the second questionable logistics system in the overall scheme. The proposal is to convert the electricity generated by the solar mirrors into microwaves and beam the microwave energy to an antenna array on the Earth's surface, where it would be reconverted to electricity and fed into a national or world electric power grid.

There is some question as to whether this double conversion of energy can be made efficient enough to deliver economically competitive electricity to the Earth, but engineering advances will probably make this at least theoretically possible. Converting electricity to microwaves and microwaves back to electricity, however, is not the real problem. The real problem is beaming the microwaves from geosynchronous orbit to the Earth.

A power satellite in geosynchronous orbit would at least theoretically maintain a fixed position 22,500 miles "above" the Earthside antenna array. The antenna array to collect the beam from each power satellite would be about a mile in diameter, which means that the beam would have to be kept constantly aligned within an error of .004%. This may be within the realm of possibility, but it makes the prospect of using unmanned, untended power satellites somewhat dubious at best.

Much more questionable are the environmental effects of such a system. In order for power satellites to supply a significant percentage of the Earth's (or the nation's) electrical power, a number of such satellite-antenna systems will be needed. The antenna arrays could be sited in uninhabited desert areas or even at sea (perhaps using cryogenic cables for power transmission) to minimize immediate and obvious effects on organisms and make the beam slippage problem irrelevant—at least in terms of safety. But what would be the effects of pumping so much microwave energy through all the layers of the atmosphere?

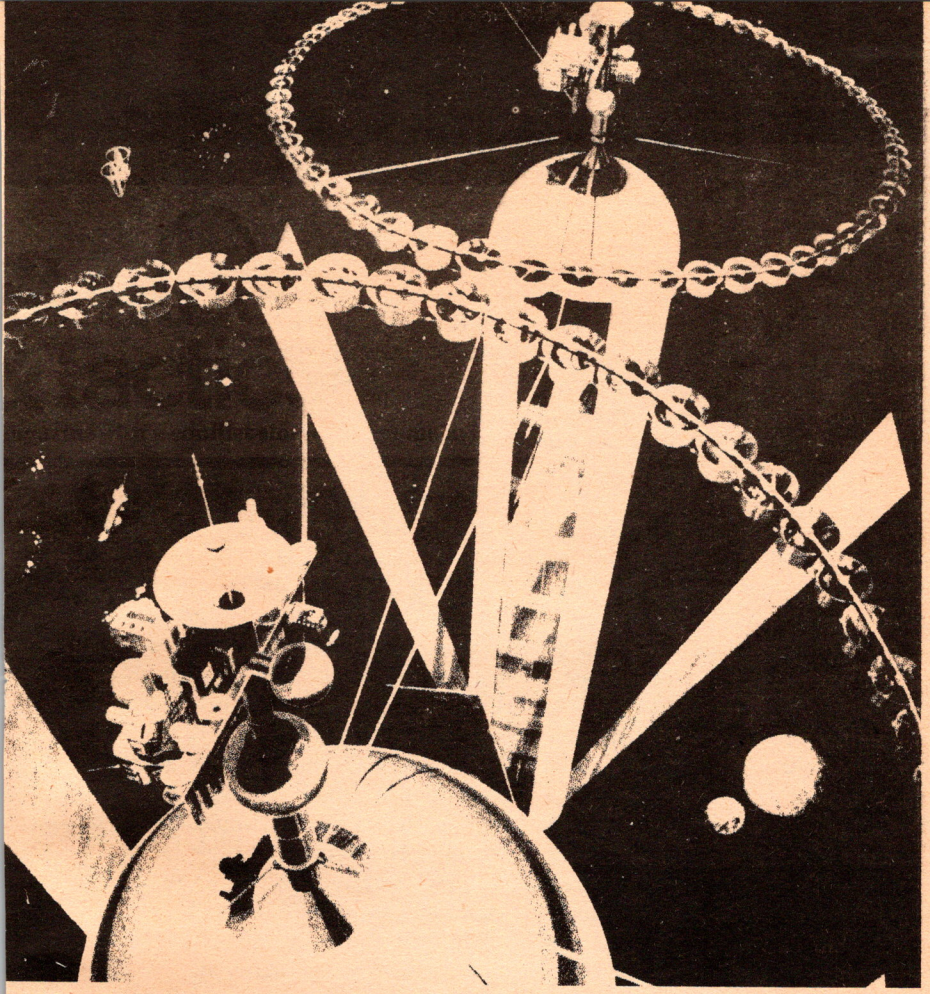
Solar mirrors provide daylight and electrical power for the colonies. The smaller structures along the ring are individual manufacturing and farming sections.

No one really knows. At least in theory, the atmosphere is supposed to be transparent to microwaves, but at a time when there is serious worry that factors like the freon from spray cans and Concorde contrails may deplete the ozone layer, it is a bit much to simply assume that multiple high energy microwave beams zapping through to the Earth from space will have no deleterious environmental effects. Even microwave oven leakage is an object of serious medical concern. According to one L-5 paper, birds flying through the beam would experience a "pleasant" raising of their body temperature. What would happen to their genes? What effect would these massive microwave beams have upon the communications satellite network and radio and television transmission? What about unknown meteorological effects, such as possible mild but permanent thermal updrafts? Could permeation of the environment by high-energy short-frequency microwaves have an effect on the cancer rate?

There are simply too many unknowns for anyone to categorically state that microwave transmission of massive amounts of power from orbit would be environmentally benign. To spend $140 to $200 billion on a total system whose economic justification depends upon taking such a supposition on faith would be grossly irresponsible.

Further, Dr. O'Neill's rather cavalier assumption that solar satellite power is the cheapest and most likely way to build an ideal energy source is just that—a cavalier assumption. Most fusion researchers currently consider $300 million their ideal annual budget, and deployment of successful fusion reactors could take place in a shorter timeframe than the L-5 project and for less money. In this light, a $200 billion program whose economic justification is to provide the same cheap, clean, inexhaustible power as fusion reactors would produce, and which relies upon a questionable piece of future technology like the transport linear accelerator and the environmentally questionable beaming of massive amounts of microwaves through the atmosphere, just doesn't seem like the best way to go if your true goal is an ideal energy source.

But *is* the creation of an ideal energy source the true goal of the



L-5 program? Or is it merely an attempt at a politically and economically expedient justification for something else—namely the existence of the L-5 10,000 man colony for its own sake?

After all, would you really *need* a work force of such magnitude and permanence to build and deploy a system of power satellites capable of supplying Earth's total energy needs (assuming that the power-generating system itself was a viable idea)? The permanence of the work force argues against its size and vice versa, especially considering the advanced space construction techniques O'Neill proposes. And what would this 10,000 man colony do after the satellite system was completed? O'Neill's answer is "build more space colonies," but

that would hardly be of significant economic value to the taxpayers of Earth who would have financed its existence.

I have left consideration of the L-5 colony itself for last because the colony is the heart of the matter in more ways than one, a grand visionary proposal that needs no Earthside economic justification, and that in a very real sense has none, at least in its present sweeping form.

Although there seem to be some variations and ambiguities in the descriptions, what is basically proposed are two cylinders, each 1km. long and 100m. in radius, linked by an axial cable. The two cylinders rotate about their common axis—in opposite directions, so as to give the total system zero angular momentum and a stable position. The cylinders are divided longitudinally into alternating strips of window (glass or plastic) and living area. Three rectangular mirrors made of aluminum foil sprout from one end of each cylinder, shrouding it. They can be opened and closed, controlling the length of day and night. By systematic stepwise increases and decreases in the length of the "days," artificial "seasons" can be created as well.

The habitat strips inside the cylinders would be landscaped and planted with trees, grass, and shrubbery, but the hydroponic farming would take place not inside the cylinders, but in a ring of small separate habitats attached to one end of the cylinder and rotating with it. Thus each crop could be grown in an atmosphere and diurnal cycle individually tailored to maximize its production. Power for the colony would be provided by a scaled-down version of the solar mirror satellites.

Thus the colony would be a closed-system ecology, independent of Earth once established: powered by the Sun, growing its own food, recycling water and oxygen through the plant-animal cycle.

O'Neill grandly styles this design "Model One," for he envisions succeeding generations of such colonies, successively scaled up from this basic design, to the point where he is talking about cylinders 32km. long, 3200m. in radius, with populations in the millions. Each step in the evolution would build the next larger model, using lunar material smelted and worked in space, and eventually using the Asteroid Belt and even moons of the outer planets as raw material.

Ultimately, what we are talking about here is the practical stepwise evolution of a modified "Dyson Sphere." Dyson hypothesized that truly advanced stellar civilizations would build a sphere of matter around their suns so as to impound the maximum amount of available energy instead of having most of it leak off into space. It has even been suggested that we might locate advanced stellar civilizations

by searching for large dark bodies that would have the characteristics of Dyson Spheres. Many science fiction stories have been written around this notion or modifications thereof, most notably Larry Niven's *Ringworld.*

But O'Neill's designs make it clear that no civilization is likely to build a literal Dyson Sphere, even if such an unimaginably gargantuan project were possible. The future that O'Neill envisions for the human race is the stepwise construction of what in effect would be a *modular* Dyson Sphere. Each O'Neill type colony would in effect be a miniature artificial planet, impounding the solar energy it needed to run its closed ecology. As human population expanded, new colonies would be built to house it, and ever more solar energy would be impounded by them, in a stepwise evolutionary manner. Eventually there could be thousands or hundreds of thousands of such space colonies or artificial planets, with a total human population in the trillions, and a diversity of cultures that would stagger the imagination. The total situation would *approach* the condition of a "Dyson Sphere" without any monster shell having to be built around the Sun.

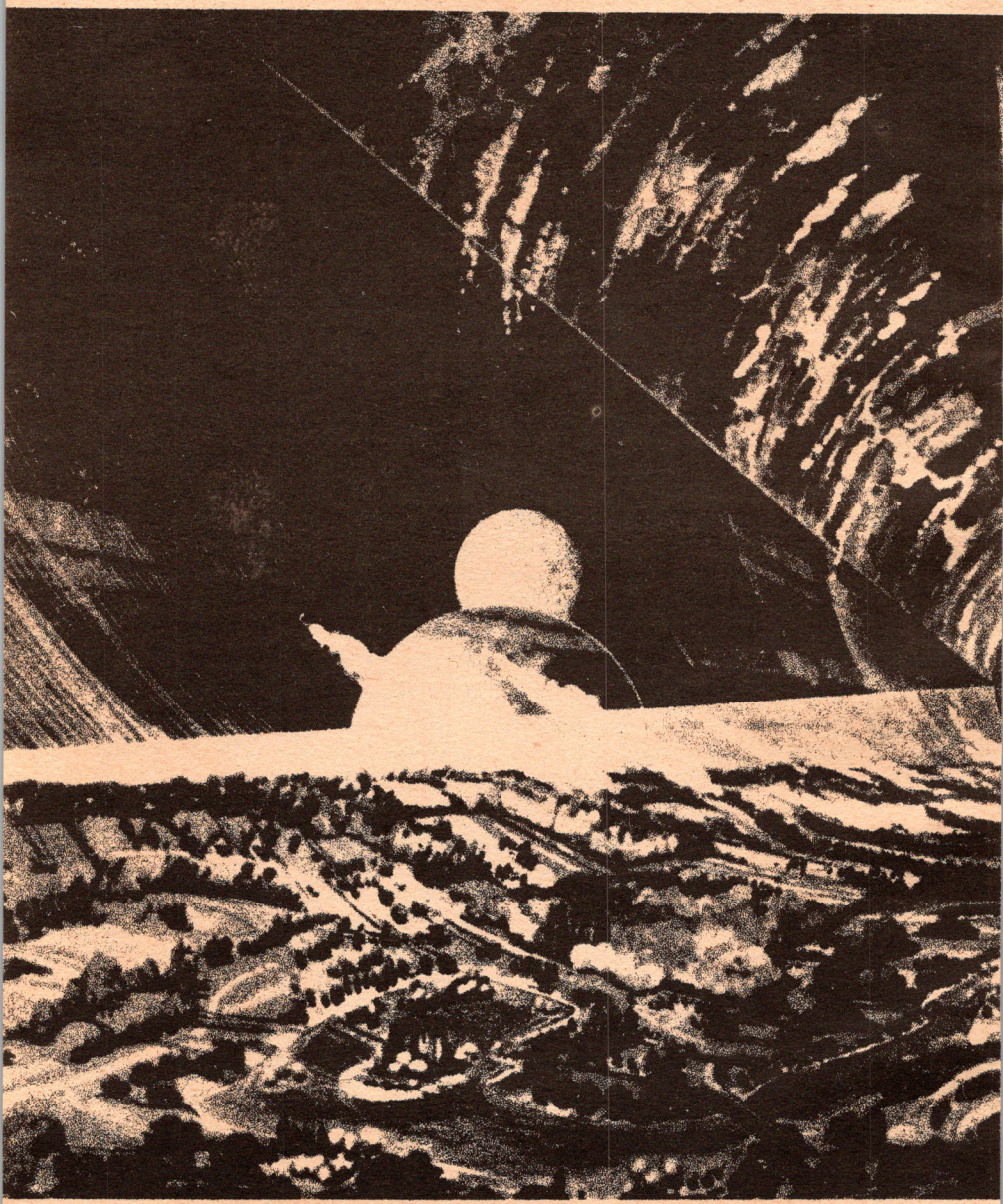
O'Neill claims that this could solve Earth's population problems and produces a chart to prove it, showing how future population expansion could be housed in space. This, of course, is true only in a long-range absolute sense—the fact that the solar system could support a population in the trillions does not necessarily mean that the Earth can support the 6-8 billion people it will have before the population can be stabilized, nor is there any realistic way that billions of people can be shipped off into space. Nevertheless, O'Neill does convincingly prove that the human race can expand its size by several orders of magnitude within this solar system.

Moreover, O'Neill has charted the evolutionary path from here to there, beginning with the 10,000 man colony, which, with great effort, could be built with something not too far from existing technology. And once such a first step is taken, the evolutionary dynamic would be begun, and would already have become self-sustaining.

Thus the L-5 colony proposal is part of a vision of future human history of immense scope and grandeur, and a fairly practical suggestion for taking the first step towards it.

In this context, it seems rather petty to try to justify it with an extremely questionable power satellite scheme. It is also poor practical politics.

O'Neill's timetable calls for completion of the L-5 colony and deployment of the power satellite system by the year 2000, which would mean an expenditure of $200 billion over about 25 years, or an av-



Through the colony's miles-long windows, the Moon and Earth are visible. All of the material for the colony—including soil, water, and air—would come from either the Moon or other bodies of the solar system.

erage annual appropriation of $8 billion. This is simply not going to happen. No Congress is going to commit itself to what amounts to a permanent tripling of the space budget under current and projected future economic conditions, and all spent on one ongoing project, to boot.

Further, if one were to accept O'Neill's rationale on face value and assume that the reason for spending this $200 billion is to permanently solve the Earth's energy problems and proceed to design a program to achieve that goal, the L-5 program is not at all what you would come up with, even if you were committed to space-borne solar power as your ideal energy source.

As previously detailed, $5 billion spent over a period of seven years (about $700 million a year) on developing a Saturn V based Flyback first stage for the Space Shuttle would give us a logistical system capable of putting 400,000 lbs. into Earth orbit at a cost of $10 million, or $25 a pound. Such a program in itself is economically affordable and even politically attractive because this advanced logistics system

would drastically reduce the costs of *all* future space operations: deployment of all manner of unmanned satellites, construction and maintenance of temporary and permanent manned space stations, and of course military applications too numerous and hideous to contemplate, as well as a possible L-5 colony program. It would put man into space on a broad, diversified, and economically viable basis; to ask Congress to swallow the entire L-5 program whole in order to justify this advanced Shuttle system would be grossly self-defeating for anyone—including the L-5 advocates.

Once this advanced Shuttle system is operational, the inevitable next step would be to use it to build and maintain one or more Permanent Manned Space Stations. Such a PMSS might be crewed by as many as 2000 people, though 200 would seem more likely for a first model. But to consider such a PMSS as simply a "Construction Shack" to be taken to the L-5 position to build a 10,000 man colony at ten times its own cost is like trying to run a four minute mile before you've learned to walk.

The first large true permanent space station should be and will be a multipurpose affair—a weather station, an astronomical observatory, a zero gravity and hard vacuum laboratory, a space manufacture test facility, and so forth. No government is going to build the first PMSS at a cost of $1 billion or so and then ship it off as a "Construction Shack" for a visionary $200 billion program.

However, a large permanent space station would provide a logistical base for a small permanent Lunar station, and it would also make it relatively easy to construct at least one good-sized pilot model of a solar power satellite and place it in a geosynchronous orbit.

We are now into the late 1980s or early 1990s in even the most optimistic timeframe, but we are now in a position to test out spaceborne solar power transmitted to the Earth as microwaves with a working model of such a system. We also have a toehold on the Moon and can begin to see how practical the mining and smelting of lunar ores will really be.

If microwave transmission of solar power to the Earth proves practical and environmentally acceptable, and *if* lunar mining pans out, and *if* a working model of a transport linear accelerator proves itself, then the question becomes: which is cheaper, boosting the materials to build solar power satellites into orbit from the Earth, or building a full-scale TLS on the Moon and a manufacturing facility in the form of an L-5 colony, and shipping the finished satellites back to Earth orbit?

Although Dr. O'Neill is confident that the L-5 manufacturing facility is the answer, I don't see how any-

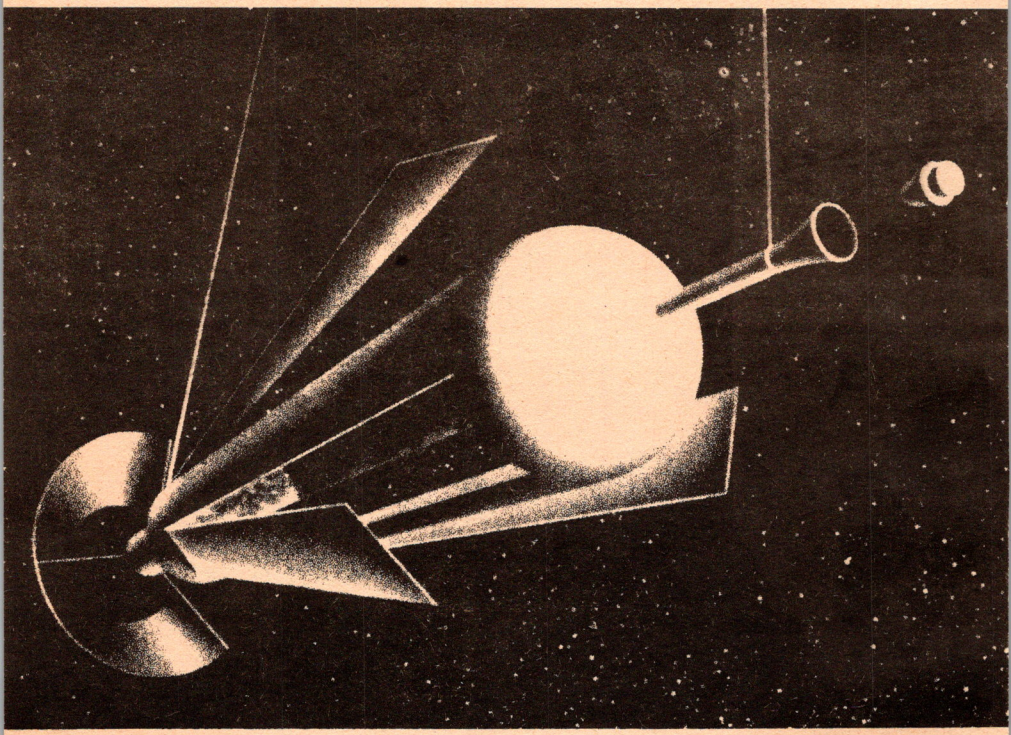
one can do anything more than guess at this point in time. And even then, it just doesn't seem to add up. By O'Neill's own figures, a completed L-5 colony, even maximizing the use of lunar materials, would still require a mass of 10,000 tons to be boosted into Earth orbit and beyond, plus the mass required to build the lunar facilities. How many power satellites could be built from such a mass in Earth orbit? How many power satellites would be needed to complete a total system?

No one can say definitively at this point, but it looks very much as if it would be cheaper to build power satellites in Earth orbit directly, using pre-fab parts boosted from Earth (mostly light foil, after all) and a permanent orbital space station as the construction site, than to spend over 100 billion extra dollars on the TLS and the 10,000 man L-5 colony so as to use lunar ore as raw material. The kicker is that O'Neill must assume greatly reduced Earth orbit boost costs in order for the L-5 colony concept to be practical, but *this same cost reduction* would apply to boosting pre-fab satellite parts directly into Earth orbit. Unless the total mass of the power satellite system would be greater than the mass that would have to be boosted beyond the Earth in order to construct the Lunar installation and the L-5 colony, which seems unlikely, there is no reason at all to build the L-5 colony and its questionable Lunar catapult if constructing a power satellite system for the Earth is the rationale.

But such a sophistry does the L-5 proposal a serious disservice, since any appropriations committee can easily do the same arithmetic. Building a system of power satellites for the Earth is not the *reason* for building the L-5 colony, only an attempt to partially justify the costs, just as developing Teflon frying pans was not the reason for building re-entry heat shields for manned space vehicles. Using spinoffs to publicly justify expenditures for space programs is an old and by now extremely lame ploy. Inevitably, the spinoff technologies could have been come by directly at much less cost.

I would submit that a 10,000 man L-5 colony is *its own* justification, given the visionary future it would open up for the human race. If the L-5 colony were built for its own sake, as a long-range investment in the future of our species, then using it to build power satellites would certainly be an economically attractive spinoff, since the costs of constructing the colony would not have to be counted against the total cost of the power satellite system. Surely, Gerard O'Neill must know this in his heart of hearts.

Perhaps O'Neill and the L-5 advocates are only trying their best to adjust politically to an ongoing and



invidious NASA public relations policy. Put simply, I believe that NASA has consistently underestimated the vision and intelligence of the American people since the early days of Project Apollo. The true reason for a manned space program is neither the technological spinoffs nor the scientific knowledge to be gained, but the development of a space-going capacity itself.

John F. Kennedy understood this when he launched Project Apollo. He did not seriously seek to justify the billions of dollars that were to be spent on Project Apollo on the basis of spinoffs or even scientific knowledge. He set a visionary goal for the American people, made the project an adventure of the spirit, and the people generally responded with their support. Perhaps it was no accident that the self-proclaimed label of the Kennedy Administration was "the New Frontier."

Space *is* the New Frontier. Indeed, it is the only physical frontier left, and unlike all previous frontiers, it is limitless and inexhaust-

A simplified view of a colony module exterior. The tether lines would be connected to another module in the actual structure.

ible in geography and in time. From a long range future perspective, Project Apollo will be seen as the end of human prehistory; everything that has gone before will be seen as but a prelude to the true human maturity. In this light, an L-5 colony will be seen as the first permanent toehold of the human race at the edge of the cosmic vastness.

Gerard O'Neill and the L-5 colony advocates obviously understand this. What they now need is the courage to proclaim it, to believe that the people at large have the grandness of soul to understand their vision if only it is explained to them honestly and fully.

The attempt by NASA to justify visionary space programs by pointing to spinoffs and new scientific knowledge while publicly ignoring what a manned space program is ultimately about has reached the inevitable dead end of dwindling public interest and reduced space appropriations. An attempt to sell something like the L-5 program using the same rationale will result in the same kind of failure.

A completed L-5 colony by the year 2000 is just not in the cards—politically, economically, perhaps even technologically. But that is not to say that the advocacy of such a detailed and visionary design is without practical merit. It is something to move towards as the manned space program goes forward. The long range possibilities it promises can give coherence, direction, drive, and public support to a more realistic stepwise expansion into space. It can give immediate impetus to an expansion of the Shuttle program and the planning of a permanent manned space station to fully exploit the logistical potentials of an advanced Shuttle system. Indeed, there is already evidence that the L-5 lobby has moved Congress in this direction.

The almost certain failure to construct an L-5 colony in this century should not be seen as a defeat by Dr. O'Neill and the L-5 advocates. For their vision has already expanded the bounds of the politically possible in the manned space program, and no doubt will continue to do so until that distant day when the dream becomes a reality. ■

KELLY FREAS

CONCLUSION

MINOTAUR IN A MUSHROOM MAZE

RICHARD and NANCY CARRIGAN

The Cretan Bull has been a symbol of power, of civilization, of wisdom... and of death.

SYNOPSIS

Most scientists hadn't believed that an elementary particle with a single magnetic pole even existed until Mario Petronelli's group at Brookhaven Laboratory found some of them. Petronelli even managed to collect a few of these elusive building blocks of nature and store them in a vat of oil. Fredrick Holzman named the particles petrons *in honor of Petronelli. His flamboyant partner was proud of his namesake and of that vat containing the only known petrons in the world. He didn't know what else it was good for but it would probably win him a Nobel prize.*

But then someone dropped a concrete shielding block on the experiment and destroyed the equipment for capturing petrons. And in the confusion a small, dark man had spirited away the petron vat. If the particles generated such violence, Petronelli realized that they must be more precious than he thought.

The physicist laid the problem before his friend, Dr. Silverman, head of a quasi-governmental agency called Science Processing, Inc. Among other things, SPI had a staff of scientist-investigators. One of these, John Leigh, had left the agency to do basic physics research, but Silverman decided that he needed to recall the physicist to solve the puzzle of the theft.

Leigh was reluctant to leave his experiment. But then Silverman told him that because of the unique south-only or north-only magnetic pole of each petron their discoverer had realized that it was possible to use them to create the dreaded anti-matter bomb. The news left Leigh little choice but to try to return the petron vat to the right hands.

He was instructed to put himself on the job market. Silverman reasoned that whoever had the petrons would need a large superconducting coil to reproduce them and that they would need staff to build one.

The only slim lead that appeared was at, of all places, a mushroom farm in western Pennsylvania. Leigh was attracted by the interviewer, Daydala Pandarou. She was beautiful and a very sharp physicist. The large coil they were building, she told him, would be used to sterilize mushroom-growing compost. It was offbeat enough to cause Leigh to take the job.

Meanwhile, in Washington, D. C. another investigator was setting off on his own game of hare and hounds. The Securities and Exchange Commission had noticed suspicious movement in stocks of some electric companies in Ohio, West Virginia, and western Pennsylvania. Investigation showed that the stocks,

purchased by various agents, were disappearing into the hands of a Lebanese banker. While not exactly illegal, the SEC was worried about who that Lebanese was fronting for. Was it possible that the Middle West would find its power companies in a Mafia-like hold? Nathan Hunter was a specialist in unknotting such tangled skeins so he too was dispatched to Pittsburgh to do some checking.

Hunter found the assignment timely for he had an ax of his own to grind in that area. His sister had written from West Virginia about a particularly heartless boiler room operation among her public health patients there. Someone was selling them stock in a firm called Golden Bull Mining, and she was worried. "Some of your people," her letter had said, "black people with just enough money to live out their days in peace . . . they give it all to the man on the telephone who promises them the moon."

Financial criminals were Nathan Hunter's favorite game and West Virginia was close enough to Pittsburgh to combine the two chases.

Meanwhile John Leigh found himself in a trap. He discovered that he and Daydala Pandarou were both employed by financier "Bull" Tauroman who housed (or held?) his staff in a unique baronial castle on an island in the middle of the Allegheny River. There Tauroman ruled supreme over a household which also included Daydala's fey, precise cousin Alexi; a herd of prize Charolais cattle serviced by the champion bull, Pride of Knossos; and a snarling pack of the most vicious pit bulldogs Leigh had ever seen, whose presence "protected" the island.

The mushroom growing was carried out in the once-abandoned maze of an old limestone mine on the mainland bank of the river. The whole setup was unusual but highly imaginative. There seemed a legitimate explanation for everything. The long coil for which he was solving the field equations was to sterilize mushroom compost. The closed-off section of the mine on level three was abandoned because of rotting timbers and dangerous rock falls. At least that's what cousin Alexi and the signs on the massive timber door said.

But if the area behind the door was unused, why did heavy electric cables run through the door jamb? Leigh found the answers when he finally eluded his watchdog, cousin Alexi, and slipped behind the door. There he found Daydala and a crew of Levantine-featured engineers working in a complete and obviously secret cryogenics laboratory. He felt that he'd made progress at last, but the news, when he finally could telephone it to Silverman, only brought the reminder that his job was to recover the vat of stolen petrons. Without proof that they had the petrons, Silverman told him, "they're as legitimate as General Motors."

Such praise made Leigh wish he'd

never left his research to return to Silverman's schemes again. But then Ariadne Boulton appeared on the scene. Abbie was Tauroman's stepdaughter and a skilled sculptor in metals and ceramics. She was working on a large job of silver soldering for Tauroman, yet she obviously detested her stepfather and his entourage of Moroccans.

But Tauroman had another enemy in his household more dangerous than his stepdaughter. Though she concealed it well, Daydala Pandarou hated the man with the intensity of a religious fanatic toward an infidel. The physicist belonged to a cult of North Africans who were descended from refugees from the destruction of the Minoan civilization on Crete thousands of years ago. The cult still worshipped the ancient Cretan Earth Mother and were committed to returning the world to her altar. A prophecy had promised them a discovery, to be made by a woman, which would humble the world before the goddess. Daydala believed herself to be this legendary woman and the petron bomb to be the miracle. She had duped Tauroman into financing her venture by showing him the other use of petron catalysis—that of a cheap and pollution-free source of electrical power.

Daydala's family had known Tauroman for many years and she knew that the financier had desecrated the grottos of the Earth Mother to collect his famous Cretan art treasures. She also knew that an uncle's death had been arranged in the process. When the petron machinery was completed, therefore, she was glad to turn the tables on her sponsor. Tauroman did not realize that, when he complained to Daydala about a SEC investigator named Nathan Hunter who was nosing around the source of their funds, Golden Bull Mining, he was handing an implacable enemy the key to his own destruction.

Daydala arranged to meet Hunter at a bar overlooking Pittsburgh's Golden Triangle. There she gave him a packet of documents which, to his surprise, tied both of his cases together into one neat bundle. They revealed that Daydala's cousin Ibrahim both received the money from the Golden Bull stock sales and was also that mysterious Lebanese banker of the electrical stock case. Happy with this break in his work, Hunter added a note to a letter he had written to his office and posted it in a box near the bar. Then he treated himself to a ride on the inclined railway which descended the bluff to where he had left his car.

He was sitting alone, enjoying the view of Pittsburgh's three rivers drawing nearer as the little antique car dropped slowly down the bluff. Suddenly the old, hand-rolled glass near his head shattered into a spiderweb pattern. Nathan Hunter was dead before the car bumped to a stop at the station below.

Nathan Hunter and his letter

arrived in Washington on the same day. Stanley Rayburn, director of the Special Investigations Unit, and Hunter's widow, Lucille, met the plane carrying the investigator's body home. Jim Anderson, who had travelled to Pittsburgh to take care of details, formed the third part of the sad trio. The grief of the three was mixed with fury at the heartlessness of the crime that had caused it. They were not aware of the mailbag which left the plane shortly after their unhappy cargo. It was the next day before the SEC realized that they had in their hands a last communication from the man who had been one of their most valuable employees.

The secretary Dee burst into tears when she saw Hunter's name neatly typed over that of the hotel in the return address. Red-eyed, she brought the envelope into Rayburn's office. "It's from Mr. Hunter," she announced unsteadily.

He looked at her in sympathy. The shell, he remembered, is very thin at twenty. "Thanks, Dee. Why don't you go get some coffee now? I won't be needing you for awhile."

"Yes, sir. Thank you." She turned and walked quickly from the room, tears threatening again.

The securities expert read quickly through the pages of the report. Hunter had, as usual, been thorough and perceptive. Combined with the papers the police had found with his body, the utilities drain would be solved. Rayburn grew angry all over again at his man's senseless death. "We'll get that murderer, damn it. Whoever ordered that rifle fired won't get away with it."

He got to the end of the letter and then reread it.

"What I don't understand," Hunter had written, "is—if a breakthrough of the magnitude she's talking about is imminent, how did they keep it so quiet? Somewhere around DC there must be someone who can give us a line on it."

Rayburn picked up the phone and dialed three numbers of an inside extension. "That you, Dykema? This is Rayburn . . . Yes, we met the plane yesterday. We'll be closing the office tomorrow afternoon for the funeral. The odd thing is, I just got a letter from him. Must have been mailed just before he was shot. And he left you a job. Listen to this." Rayburn read the last part of Hunter's letter to the director of his research staff. "Drop everything else and let me know as soon as possible what you come up with. Any hint in the trade journals, financial pages, public press. It's top priority . . . You're damn right. They aren't going around shooting our people and getting away with it."

He hung up the phone and turned his attention to the running of his office. At three o'clock Dee came in again.

"Mr. Rayburn, Mr. Dykema's on the phone."

"Already? Put him on.

"Hello, Hans. Didn't think you'd be done so fast . . ."

Rayburn listened impatiently as the other spoke, then he replied.

"So Wilmont was writing a status report for Hunter . . . just getting it typed? Great! Timing couldn't be better. What's he got? . . . Congress kicking around a new dam out West, . . . Russians having some more luck with the Tokomak plasma, . . . ERDA coming up with new grants for fast breeder nuclear power plants, . . . no new regulations for stock dealings in utilities.

"Hell, I can get most of that reading *Time* . . . OK, OK, *Fortune* and *Science* too. But that's not what Hunter was talking about. All that stuff's been in the wind for months or even years. It's general knowledge. He's talking about something new, revolutionary, something that would knock the whole industry back on its heels."

He looked disappointed as he listened to Dykema's voice on the other end of the line.

"Nothing, eh? Well, thanks anyway. I didn't mean to belittle your man. I'm sure he did a good job with what he had, but either he missed something or the secrecy around this thing's been fantastic.

"Keep a watch anyway. Bye."

Rayburn hung up and leaned back in his chair. "Somebody ought to know," he mused. Then he sat up abruptly. "Kaplan. Walter Kaplan. Knows investigative agencies, once worked with the CIA, best securities man in the business, and one of our own commissioners." He picked up the phone again and dialed Kaplan's private line.

"Hello Walter, this is Stan . . .

"Yes, I met the plane yesterday. Another investigator, Jim Anderson, went over to Pittsburgh to fly back with him . . ."

Rayburn's face took on a grim look as he listened to the Commissioner.

"It was a bad shock. For us too.

"Say," he got right to the point, "the odd thing is, I just got a letter from him. Must have mailed it minutes before he was shot."

Rayburn picked up the letter and read the last, handwritten paragraph to Kaplan.

"Research here doesn't have anything that isn't fairly common knowledge. Hunter had ordered a report of new developments in the industry even before he heard of this mystery lady and the information was just being typed when I checked with our research people. But he's—was—right. I can't believe that something so big could be kept that secret. Someone must know what's going on."

As the other answered, Rayburn smiled for the first time in two days.

"SPI?" he asked. "What the hell kind of an acronym is that? No, I don't know Silverman, but if he can help us solve this, I don't care

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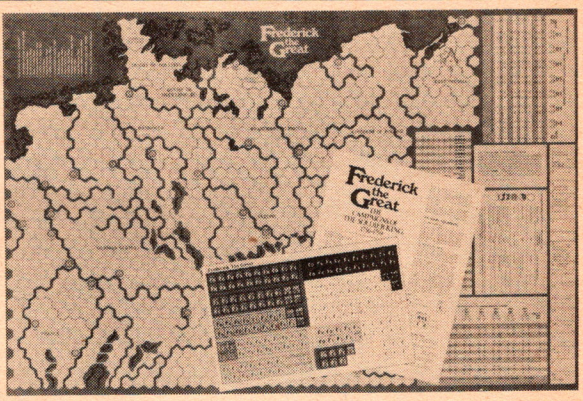

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what he calls his department. Hunter was a good man—one of our best. We're going to crack this case, Walter, if I have to go to the Hill and the White House!"

Kaplan interrupted him and Rayburn realized that he had been shouting. He listened to the Commissioner, his usually even temper cooling as he did so. His voice was normal when he answered Kaplan.

"You're right. It sounds as if this SPI may be just what we need. I'll be waiting to hear what they come up with. I hope it's good. Thanks for looking into it, Walter. For Hunter's sake I really want this job to be done right.

"Good-bye."

Rayburn hung up the phone and in spite of his mood smiled again. SPI? Washington's alphabet-soup game had come up with some funny ones, but that one took the cake. He thought that he'd like to meet the man who'd thought up that nose-thumbing bit of nonsense.

Back in his own office, Walter Kaplan also hung up his phone, told his secretary he was not to be disturbed for a while and went into a closet-sized room just off his main office. The walls and ceiling of the room were covered with acoustical tile. The floor was a continuation of the deep-blue pile rug from the main office. A light-brown teletype machine of the sort one sees for making advanced reservations in a hotel rested in the middle of the room on a small chrome-trimmed desk. A very observant person would notice that the machine was slightly different from the hotel variety, however. It had attached to it a cabinet about the size of four shoe boxes formed into a rectangle. Several small indicator lights and a series of sixteen microswitches were visible along the side. On the top of the box was a telephone cradle. The box was several times the size of the ones normally used with computer time-sharing services.

Kaplan switched the teletype on, set the microswitches on the box and dialed the telephone that stood beside it. On the first ring he placed the telephone into the cradle so that the teletype was now connected over the telephone line to the remote computer he had dialed. Over the door of the room a blue light went off and a red one came on. In a moment the teletype began to clatter.

STATION 312, 16:40, ALL SYSTEMS UP, FORTRAN MONITOR ON. SYSTEM IN OPERATION UNTIL 23:50. WASHINGTON LINK OPERATING PLEASE GIVE USER NUMBER.

Kaplan typed in an eight digit number.

The machine responded.

CODE.

There were bursts of typing as the man-machine dialog continued. Kaplan identified himself in what Rayburn had just called the Wash-

ington alphabet-soup game. Finally the tan box was satisfied. The computer typed out the words,

SECRET. WIRES CLEAR. WHAT IS YOUR QUESTION?

Kaplan wrote,

HAVE PROBLEM REGARDING RECENT MURDER OF INVESTIGATOR OF SEC. WE HAVE RECEIVED HIS LAST COMMUNICATION WRITTEN JUST BEFORE HIS DEATH. IN IT HE SAYS THAT A WOMAN INFORMER CLAIMS TO HAVE INVENTED A NEW, REPEAT NEW, CHEAP, POLLUTION-FREE SOURCE OF ELECTRICAL POWER. OUR RESEARCH DEPARTMENT HAS NOTHING ON THIS. WHAT HAVE YOU GOT?

The machine replied,

MESSAGE RECEIVED. STAND BY FOR ANSWER.

At the Long Island headquarters of Science Processing, Inc., the Communications and Research Apparatus, affectionately known as CARA, mulled over the key words that Kaplan's message had given it. NEW, POLLUTION-FREE, ELECTRICAL POWER, WOMAN, SECURITIES AND EXCHANGE COMMISSION. Tapes spun and information passed quickly through the masses of electrical circuitry. In a brief minute CARA was sending a message to Kaplan's office in Washington.

POSSIBLE NEW SOURCE OF ELECTRICITY SPECULATED UPON BY M. PETRONELLI. INVOLVES NEWLY-DISCOVERED PARTICLE CALLED PETRON. POWER RESULTS FROM PROCESS CALLED PETRON CATALYSIS. PROCESS ONLY THEORETICAL AT THIS TIME DUE TO DESTRUCTION OF EXPERIMENT WHICH HAD PRODUCED THE ONLY PETRONS IN EXISTENCE. THESE PETRONS WERE STOLEN AT THE TIME OF DESTRUCTION. INVESTIGATION OF THE THEFT CONTINUING. WOMAN POSSIBLY INVOLVED. OUT.

Kaplan typed the single word, BYE, into the teletype, threw another switch and in a final gaggling burst, the machine listed the time, the central processor charge units, and then seemed to sputter into a fitful sleep. The red light over the door went out and the blue one came back on.

Kaplan tore off the message from the teletype and took it to his desk where he read it again and again. Finally he reached over to the intercom and summoned "The Dragon," as his children had christened his formidable secretary.

"Mrs. Halpern, I'd like you to get a hold of Dr. Silverman of Science Processing, Inc. on Long Island. The number is in your files."

"Yes, Mr. Kaplan."

When the phone on his desk buzzed, Kaplan picked it up and spoke familiarly to the man on the other end of the line.

"Since when has CARA gone in for cryptic messages? You folks practicing to write spy stories out there?"

Silverman, puzzled, finally placed the voice. "Hello, Walter. Since when has our rhetoric bothered you? I've always thought our messages were models of computer English."

"Well, this one says, 'Woman possibly involved,' and talks about experiments getting smashed and rare particles stolen. All I wanted to find out was if you people knew about a new source of electrical power and I get back a plot for a novel. What's it all about?"

"Wait a minute. Emily's getting me a copy of your message."

There was a pause.

"Well, as far as I can see, you got a pretty straight story. Mario Petronelli, a physicist working on the storage rings here on Long Island, found these rare particles and stored them in a vat. Someone destroyed his experimental apparatus and nearly killed his associate, Fredrick Holzman. The same bunch stole the vat of particles. I've got an agent working on the case now. He thinks he's traced the particles to a place near Pittsburgh . . ."

"Pittsburgh!" Kaplan interrupted. "Actually just outside the city at a place called Westpenn Foods. The outfit is owned by a financier named Clinton Tauroman."

Kaplan's excited voice broke in. "Can you get to Washington as soon as possible? I think we're on the same trail. These people seem willing to play rough. As I told CARA, we think they've just killed a member of our Special Investigations Unit. We'd better pool our information before they do any more harm."

Silverman caught the last Allegheny flight to Washington from McArthur Field that night. Promptly at nine the next morning he was in Walter Kaplan's office surveying the impressive art collection which brightened the walls of what had once been a standard government office. A sharp, clean Mondrian, the splash of Warhol's lesser-known flowers, a lonely vista of Edward Hopper, and Ernst Trova's mystically-alive hood ornaments marching and spinning in circles cried for his attention.

"This is only part of the collection," Kaplan told him. "You see, as an SEC Commissioner I'm not allowed to invest in stocks which would come under the jurisdiction of the SEC. That leaves me rather few options. Molly and I like art, and I only buy what pleases us."

"I like your collection too," Silverman replied, "but is it all that good as an investment? Can you buy just because you like some-

thing and still make money on your investment?"

Kaplan explained. "I've been told by reputable dealers that the collection's grown greatly in value over the years. You see, I bought Trova before anyone else did, because I liked him. Now people buy him because he's both the thing to do and famous, so his prices have doubled and tripled and more. He doesn't need me anymore, though I still like him."

"Mr. Kaplan. Mr. Rayburn and Mr. Halloran are here," Mrs. Halpern interrupted.

"Fine. Send them in." He turned to Silverman. "Rayburn's head of the Special Investigations Unit and Halloran's the top SEC enforcement lawyer. They'll both be able to fill you in on the gaps in the story I've already told you. This is a real shocker for them. People just don't murder our investigators, you know."

The two SEC men entered and were introduced to Silverman. Then Kaplan motioned them to seats around the small conference table at the end of his office. Each man took out his notes and waited. Kaplan took charge.

"First, Stan, Mike, I'd like you to hear the background on Dr. Silverman's work and his investigation. Then we'll hear what you've got."

Silverman's soft, Boston drawl took over.

"First, about Science Processing. As you all know, we are living in a technological age. Survival in a technological world can depend upon technological superiority. A facet of this superiority is the efficiency with which new developments can be absorbed into the fabric of the society. Science Processing was created to keep an ear to all phases of technology both here and around the world so that government policy which may be affected by technological advances can be intelligently made. We have a master computer called CARA which interested government agencies may use to find out the state of technology in their fields. It was through the use of the computer that I was called into your case today. It so happens that our operational division has been working on a case of blatant and unusual sabotage in which an experiment was smashed and some valuable property belonging to the Energy Research and Development Agency was stolen. It seems that there is a possibility of a link between this sabotage and theft and the investigation being run by one of your own men who, I understand, has just been murdered."

Kaplan took over. "Stan and Mike are both familiar with the letter I read you, so now we'll try to link the possibilities together."

Carefully the four men went over the information each of them had at their fingertips. There seemed little doubt when they had finished that they were working on

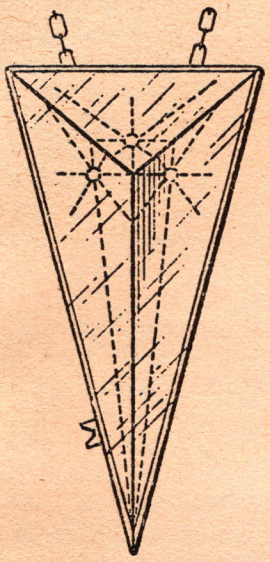
the same case, but for different reasons.

"I know very little about the law in these cases," Silverman queried Halloran. "What is Tauroman doing that is illegal?"

"He has sought to circumvent the intent of the Securities Act in a number of ways, though he has been very clever in doing so. The first step in his operation that 'bent' the law badly was the boiler room tactics used to sell the Golden Bull stock. He complied with all the rules there save one known as the 'new capital' rule. His salesmen delayed delivery of thousands of dollars worth of stock certificates already sold to prevent customers selling them back before they were ready to have that stock back on the market. However, the stock was no longer theirs but the buyers'. That means it was a liability on the dealers' books. Since the law says that a broker-dealer must have cash assets to exceed all liabilities except those covered by other assets, we got the boiler room dealers on this and have already started closing down the dealers of that stock.

"As for the mystery lady's papers, they and her interview with Mr. Hunter show that Tauroman planned a massive circumvention of the Utilities Act, or Title 15. This act was set up to assure 'arm's length bargaining' in the Utilities business. It is designed to separate the producing company, (the phase of the business which actually makes and delivers the power,) from the holding company which is a financial entity and basically unproductive. If Tauroman owned both this new process which Professor Petronelli speculated upon and the mystery lady claims to have perfected, and the control stock in the companies which would be forced to use it or go out of business, he would control both the price asked for the process and the price the utility would be authorized to pay. This absence of 'arm's length bargaining' is what the law is all about. Tauroman used the North African ploy to hide the fact that the ownership of the utility stock was effectively in his hands. Now that this is known to us, he will either have to divest himself of the new process or of the stock. Either way, his plan,—and it's a damned clever one; I'd like to meet his lawyer—is blown sky-high. If he has a single murderous bone in his body, I'd say the mystery lady's in danger once he knows that we've got those papers."

"Unless Hunter's death was a horrible fluke and the work of some crazy, racist sniper as the newspapers have speculated, there's a good chance that this man, Tauroman, is one of the most dangerous the SEC has ever had to deal with. Even when we were investigating Mafia infiltration into the market years ago, no one laid a finger on any of our men," Rayburn added. "None of us would



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have thought of carrying a gun."

"So it would seem that your man may be in danger also," Kaplan said to Silverman.

"Hmmm, yes. I have to add that he's rather used to danger and is quite well trained to defend himself, but I will want to get this background to him as quickly as possible. What course is open to you now?"

The lawyer, Halloran, answered. "In this case where we're trying for a criminal conviction, the SEC gets sufficient evidence to warrant intervention by the Attorney General. The AG's office then handles the court proceedings using, of course, all the background material we give them. And believe me, with those papers from the mystery lady, we've got plenty. I'd say Tauroman will surely get a prison sentence and a stiff fine, to say nothing of what the tax men will do to him when we're through. And this is over and above possible involvement in Hunter's death. I'm glad I'm not in his shoes."

"You say your operational division has been working on this," Rayburn asked. "Can your investigator help us any?" His curiosity over the idea of a scientific swashbuckler was ill-concealed.

"Anything Dr. Leigh finds out will, of course, be available to you, but his job basically is to find the missing vat of petrons and return them to ERDA. Our legal consul-

tant and those of Dr. Petronelli and the national laboratory involved are worried that a lawsuit might give too many crackpot ideas to too many unstable characters. The laboratory's work is not defense. It is research. But too many people since World War II equate all science with bomb building. Some of these individuals have set bombs in particle research installations already because of this misconception. We're afraid that the publicity attendant upon such a case might give them more ideas. Mainly we just want to get the petrons back as soon as possible so that Dr. Petronelli and his colleagues can continue their work."

"I see," said Rayburn. He was aching to ask how, when, and a dozen other questions, but Silverman seemed to have said all he intended to on the subject.

The meeting essentially over, Rayburn and Halloran soon left.

"Leigh?" asked Kaplan when they had gone. "Is that the same fellow who handled the deal when that astronomer got a message from outer space?"

"Yes," Silverman nodded.

"Good man," Kaplan said. "I was impressed with his work."

"Very good," Silverman agreed.

"Better take care of him" Kaplan cautioned. "We've lost one good man too many on this case already."

Leigh came down to dinner early that night and found the main room of the Hall deserted except for Ariadne's tall figure sprawled on the couch in front of the fire, her feet up on the coffee table, reading a copy of *Art News*. Her face was set in a scowl of disgust. When she saw him, she threw the magazine toward the table with a muttered expletive he didn't quite catch.

John sat down next to her.

"What's the matter? Some critic saying nasty things about my favorite artist?"

"Nasty would be better than nothing," she growled at him. "And that's just what they're saying—nothing. Too damn provincial to get off their New York asses and see what the rest of the great United States is up to. They deigned to mention the sculpture show at the Carnegie (in most condescending terms, of course) but look at this!"

She picked up the magazine again and leafed to the back. "Galleries Downtown, below 14th St.; Galleries Lower Midtown, 14th to 53rd Street; Galleries Midtown 53rd to 65th St.; Galleries above 65th St.; Galleries on Garbage Scows in the East River . . ."

"Garbage Scows on the East . . .?" John looked at her startled.

"Well, they cover any kind of garbage so long as it's shown in New York," she said crossly. "But the rest of us working out here in the hinterland like Pittsburgh might

as well still be painting in caves. What a bunch of cow crap!"

She threw the magazine down again.

"Cow crap? I thought the expression was bull . . ."

Ariadne flashed him a woman's lib signal, her eyes twinkling.

"We gals in the movement demand equal rights, right? So why not cow crap?"

John was beginning to feel as if he'd gotten trapped in a revolving door. He decided to change the subject.

"Say, how's your welding coming? Is the silver tank finished?"

"Not bad if I do say so myself. I told you once before, I'm a damn good welder. You don't believe me, come take a look at that job I've done for Bull and his Moroccan mama."

"As a matter of fact, I'd really like to see it. Would you mind if I joined you some night while you work, or does it make you nervous?"

"Me? Nervous? Don't tell me you're going to turn out to be some sort of male chauvinist pig, worried that your masculine presence would make my dainty hands tremble." She held out her big, competent-looking hands. They were feminine enough, but John couldn't, somehow, picture them trembling. Damn! These women's lib types were touchy.

Abbie, seeing him frowning and at a loss for words, realized that she'd done it again. Everyone else took things so seriously. With the single exception of her mother's death, she never took anything seriously, including herself. She laid a gentle hand on his arm and gave him the winning smile that had gotten her out of so many similar scrapes.

"I'm sorry. I didn't mean to sound bitchy. Actually, I'm finishing up Daydala's job tonight after dinner, and frankly I'd love it if you'd come to keep me company. For some reason they've got the thing way back in the old part of the mine. It's plenty spooky back there. Do you have time tonight, or is that too short notice?"

"No, tonight's fine. I've been wanting to see your work, and you. You're very elusive, you know. I haven't had a chance to talk to you alone almost since we met. How will I find you? And at what time? That place is such a maze, we'd better know exactly what our plans are."

"You're right. Meet me in the breakfast room at ten. It'll be fun. And at least we'll be away from the others. In fact, here comes darling Daydala now."

Ariadne nodded to the physicist as she came in from the foyer. Bull drifted in from his study and soon Alexi completed the little group gathering for the evening meal.

The butler had just announced dinner when the phone rang.

"Yes, he's here. Just a minute,

please," Bull's voice sounded a bit puzzled. He turned to Leigh and said, "It's for you. A young lady." His frown said all it needed to about Leigh having given out the Hall's number and about him getting tangled up with women at all.

Leigh's mind, meanwhile, was working rapidly. There was only one person who knew where he was and the telephone number where he could be reached. That was Silverman. A young lady could mean Emily perhaps. In any case, it was a message from SPI. He put on an embarrassed look. "A young lady. I . . . I'll take it in my room. Please don't wait dinner for me. She . . . I . . . we . . . I'll be down as quickly as I can."

He turned and left the room. Ariadne looked after him, puzzled. *Well, why not?* she shrugged mentally. *A nice, big, sexy guy like that. Why should you expect to find him unattached?*

Bull motioned to the two women to follow him into the dining room. A look at Alexi made the Moroccan's duty quite clear. As the rest left to go to their dinner, Alexi picked up the phone and put it to his ear.

There was a pause and then the eavesdropper heard a pleasant, friendly voice answer Leigh's "Hello?"

"John, honey. It's me, Felicia. Remember?"

Remember? How could he forget that cozy party for two that had marked his leaving his comfortable apartment in Illinois? Felicia had come in from her flight all glowing with good health and cheer and then wept when she found that he was leaving to take a new job in Pennsylvania. They had comforted each other the way they knew best. He remembered. But that was all he had told her—that he was leaving to take a new job in Pennsylvania. How had she trailed him here?

"I was on a flight a few days ago and guess who I met? That nice man with the Boston accent who came to your apartment that time, you know, the one with the silver and black hair? He told me where you were and said to say hello the next time I came through."

There was a slight interference on the line.

"Felicia! This is a surprise. I sure have missed you. Wait 'til I get comfortable and then let's start this conversation all over again."

Leigh drew out the cigarette case-cum-tape recorder and fastened the wafers to the phone, his hands almost fumbling in their haste.

She had started the recorded message from Silverman too soon. He hoped that she'd gotten the hint and rewound to start again.

"There," he told her, "That's better. Now then, let's start again. You say you saw my friend from Boston?"

"Yes, and he said to say hello."

There was a split second pause

and then the interference started again. Leigh smiled to himself. *Good girl*, he applauded her silently. Now to make small talk until the recording ended. With a girl like Felicia, that wasn't hard.

"Well good for him. But what about you? What have you been up to since I left? It sure isn't the same without you."

For a stewardess the gift of idle conversation comes easily and soon Felicia was rambling pleasantly on about her last flight, the nasty old drunk who'd pinched her, the little boy who'd wanted to open the emergency doors in midflight, the wild-talking weirdo who'd given them all a hijacking scare. In the meantime the background hum continued.

". . . there's a nice young couple in your old apartment now. Students, I think. It's a lot different," she said wistfully.

"It is for me too," he answered truthfully, "but the money was too good. I just couldn't pass it up. Maybe someday I'll be back. When I make a bundle and can retire and do nothing except physics and making love."

"In that order?" she teased.

"It depends on whether you're on a flight or not."

Below in the Hall, Alexi looked at the phone in distaste.

"Well, I'm in Pittsburgh right now . . ." Her voice was rich with suggestion.

Leigh calculated quickly. He had to see Ariadne's silver tank. It would be finished tonight, she'd said. But perhaps Felicia had a further message from Silverman. The interference on the line had stopped. He thought it over and decided that the last hint was purely Felicia's own, otherwise there would have been no taped message, only an insistence upon a date. He remembered that soft, dark-blonde hair and Felicia's many talents and looked at his watch. It was well past eight and Ariadne expected him at ten. Even for Felicia he just couldn't get into town and back in time. And Ariadne's kettle was too important to miss. There was real regret in his voice as he answered.

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"It sounds great, Felicia. I sure wish I could get away, but this is a busy place. I just can't make it tonight. When will you be in town again?"

"Who knows?" she sounded miffed and disappointed. "Maybe I'll see you in Chicago." Her good humor quickly bounced back, a delightful trait which endeared her to several men with complicated personal lives. "Take care of yourself. I'll tell your friend that I talked to you next time I see him."

"Yes. Tell him thanks for thinking of me. I don't know when I'll see him again either, but I'll look him up as soon as I can."

"I have to go, love. We're just going out to dinner. Take care of yourself, whatever you're up to."

"So long, honey. You were sweet to call. Happy Landings."

Alexi frowned at the kiss-blowing that followed and then hung up and went in to dinner.

Leigh, in the privacy of his room, started the playback on the little scrambler. The tiny ICS in the microminiaturized circuits bit and tore at the time and frequency spectrum of the slight static hiss on the tape, carefully reassembling it into Silverman's familiar voice.

"Hello, John. It was urgent that we get a message to you and I have asked the charming young lady who lived across the hall from you to deliver it. Since you are now listening to me, her efforts have obviously been successful.

"The case you are working on has become even more complicated than I had anticipated . . ."

In his slow, precise way the head of SPI told his agent all that he had learned about the case—of Nathan Hunter's death; of the papers the investigator had received from a woman who fit a description of Daydala Pandarou in every way; and most important, of the claim the woman had made about her discovery.

". . . so if what she told Hunter is correct, things are coming to a head. And if our speculations concerning his death are correct, you may be dealing with a murderous crowd.

"In the light of these new developments we have set up a field office near the island where you are staying. It is at an abandoned laboratory in Saxonburg. Here is the number there. Commit it to memory."

He gave the telephone number.

"If you need help, get in touch with them. There's a man there at all times. He'll get reinforcements if you need them and will be ready to receive the petrons when you find them. That's all from here. Good luck."

The tape spun wordlessly to an end. Leigh set the erase and folded the instrument away.

There was nothing he wanted more than to sit and think about the information he had just received, but the others would be

waiting for him downstairs. Regretfully he put the cigarette case away and returned to the dining room.

It was hard to concentrate on eating after what he had just heard. He glanced across the table at Daydala—beautiful, overtly submissive to the massive, tough man sitting next to her, yet apparently double-crossing him neatly and completely. So she claims she's developed a new source of electricity? It could only be the petron catalysis they had decided could be behind the original theft. After all, there was the silver kettle almost finished. Which brings us, he thought, to Ariadne. He looked at the big, open-faced, frankly exciting girl sitting next to him. How much did she know? Why had she returned to the Hall? And why did she work so willingly on the kettle if she was completely innocent? She seemed a bit cool tonight. He wished he knew why.

Then there was Alexi. His name was Pandarou also. Had he supplied the papers to double-cross Tauroman? Where did he fit in? He suddenly realized that Ariadne was talking to him.

"So you're not quite unattached. Is she the only one or are there more? I'm not going after you if the field's too big. I haven't got the time to fight off a crowd."

Leigh laughed.

"My dear Ms. Boulton. With you around, there isn't any competition," he said gallantly. He added to himself, *Hell, you'd take them two falls out of three and I wouldn't mind taking the winner.*

"Actually," he continued aloud, "she's a stewardess I used to know in Chicago. She was in town on a layover and called up to say hello. An old friend," he added as if that explained everything. He said no more as he ate rapidly to catch up with the rest.

After dinner everyone excused themselves to attend to various tasks—Daydala to work, Bull and Alexi on some business of their own. It was past nine o'clock. John decided to go up again to his room and kill the time thinking about his problems, but he ended up daydreaming about Felicia and Ariadne and was half-asleep when the little wrist alarm on his watch went off at five minutes to ten.

Ariadne stood waiting just inside the French doors leading from the breakfast room to the court. Outside in the distance one could hear the howling of the dogs. The girl shook her head.

"Damn vicious beasts. We'll have to get right into the car if we're to avoid them. Come on."

They moved quickly from the door to a yellow Toyota coupe. Ariadne started the little car, put it in gear, and they plunged down the road to the building which housed the elevator shaft. She parked as close to the door as possible and they darted quickly inside. At the bottom of the shaft, she unplugged

one of the two-seater Cushman electric cars, motioned Leigh to sit beside her and barreled off down the tunnel under the river. In her hands the Toyota had been treated like a Ferrari. The Cushman, for all its lumbering slowness, bucked and took off like a charging motorcycle. Leigh decided that, women's lib or not, he would do the driving the next time he and Ms. Boulton were in a vehicle together.

Only the night lights were on in level three, but Ariadne strode confidently to the big timber door behind which Leigh had found the secret laboratory. She pulled it open and motioned him inside. As the door closed behind them, she reached for a switch and the tunnel was filled with light as it had been when Leigh found himself trapped in it earlier. Again the tall girl took off at a brisk pace. They strode past the cryogenic lab. She never slackened her pace for a moment and he glanced regretfully at the equipment he would have liked to inspect much more closely.

"Complicated place," he commented. "I'm sure glad you know the way. It'd be a problem getting out of here if the power failed."

"Not at all," Abbie explained. "You just have to follow the signs."

"Signs? Where? I don't see any signs," John answered, looking around him.

"Haha!" Ariadne teased. "They're right in front of you. Give me your hand."

Leigh put his hand in hers. It was the first time he had touched her. Ariadne, he found, generated her own brand of electricity—a kind a lot more interesting than the variety Daydala was cooking up. He drew her toward him and experimented with creating a few sparks of his own.

The results were positive.

Finally she pushed him away.

"Now just a doggone minute. I've got work to do tonight and I was going to show you something," she protested. "Now where were we?"

"Right here, last time I looked," he said and pulled her close again.

"No, no. I . . . oh yes, the secret of the mine.

"Now stop that," she giggled, "and pay attention."

"I am. I am," he answered and they both burst out laughing. "You were showing me the signs that led out of the mine."

"Yes. You see these tiles here that are carved with this medallion pattern? They're your signs." She guided his hand to the center of one of the medallions. "Feel the center of that tile. The circle looks smooth, but if you run your hand across it, you can feel an arrow just faintly in the glaze. That arrow points to the quickest way out. Dead-end corridors have no arrows. Clever, huh? That stepfather of mine's a sneaky son-of-a-bitch."

Leigh's fingertips probed the slightly concave surface of the me-

dallion. Sure enough. Placed into the smooth surface of the glaze was a rough part in the middle that proved to be the shape of an arrow.

"Pretty smart," Leigh admitted.

"Those tiles line the whole mine, so if there's ever a power failure, you can always find your way out."

"It must have been expensive, putting those in."

"I'm sure it was," the girl replied. "But Bull has this thing about mazes. He loves games like that tower game of his and that little wooden box where you work a ball through a maze by tipping the box this way and that. The only thing is he always wants to win. He wants to know the secret so that he comes out safely even if everyone else is trapped. In his mind the expense was worth it. Bull Tauroman's never going to be trapped if he can help it. Now you know his secret, so you don't need to be trapped either."

They turned to the right and then to the left, passing dead ends as they went. Leigh experimented with finding his way with the tiles. It was rather like a child's game. They turned a corner and Ariadne pulled open another huge timber door and groped inside for the light switch. There was a brief flickering uncertainty as rows of fluorescent lamps in the ceiling warmed up and steadied, and Leigh found himself in a huge room, cavernous as a church. His eyes widened in surprise.

Occupying the center section of the room was a tremendous structure more than two stories high. One part looked vaguely like the kind of giant kettle one would have seen in the Heinz soup factory not far from them in downtown Pittsburgh.

Running into this from the side was Leigh's solenoid, giving the whole structure the same general configuration as that of a tobacco pipe with the solenoid forming the stem.

There the resemblance ended, for the "pipe" was encrusted with intricate scientific detailing from top to bottom. Electrical coils stuck out here while there endless piping ran off to mysterious places. Narrow ladders and platforms gave access to difficult-to-reach parts above. It was spectacular. Leigh let out a soft whistle.

Ariadne smiled, pleased. "Well, how do you like it?" she asked, her voice echoing in the rock-lined room.

"I'm impressed. The solenoid I knew about. I helped to do the field designs for it. But that sphere at the end of it, that's all new to me."

"Well, I don't know what a solenoid is, but that sphere is my kettle," Ariadne said with a strong hint of pride in her voice. "I welded that. In fact, I'm going to finish it right now so I'll have no more kissing, Dr. Leigh. Just sit

down and tell me nice things while I get to work."

She had gone to a large chest nearby and gotten out her welding equipment. The heavy welder's mask and gauntlet gloves transformed her into a rather formidable, sexless creature as she disappeared around the side of the kettle, talking as she went.

For several hours they chatted in a pleasant, desultory fashion as she worked. Leigh wandered all over the room as they talked but there was no sign of the missing petron vat to be seen.

"I got the inside finished last night. Silver, and damned hard to work on," Ariadne explained. "Just have to finish up a few spots over here and that's it. Never saw people so antsy to get a job done. I'll be glad when it's over."

"Silver, you say. That must have cost your stepfather a lot."

"You worry about that old bastard's pocketbook too much," her voice came hollowly from under the mask. "He never minds spending money to make it. I don't know what all this is for, but you can be sure this kettle will cook him up a hundred times what it cost him, or he wouldn't build it."

"But what do you get out of it?" Leigh asked curiously.

The muffled answer was cryptic. "That's between him and me." She would offer no further explanation.

"And you just build this thing and don't know anything about what it's supposed to do?" he asked after a pause.

"Haven't a clue. You're a physicist. You tell me."

"I'm not sure myself. What's all the cryogenic stuff on your pot used for?"

"Cryo—what? I don't even know what you just said."

"I'm talking about all that piping up there."

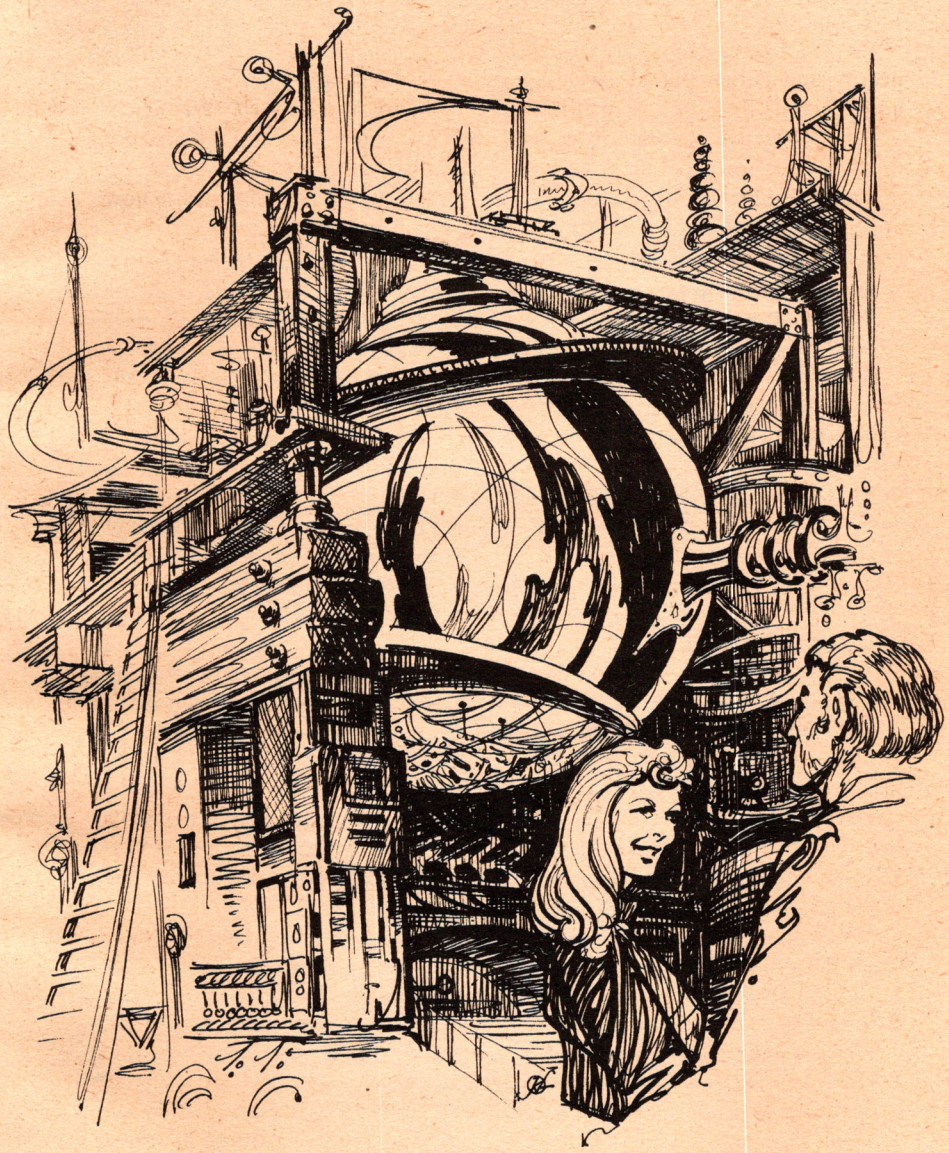
"Oh, that! Daydala and her friends run some sort of chemical into it. Makes lots of ice and vapor. Then she comes around with some sort of sniffer gadget. I think she's looking for leaks. If she finds any she gets mad as hell and makes me go back inside the pot and rework the silver." Ariadne had apparently finished her work for she was now standing beside him, pulling off her gloves as she talked.

"Can I see the inside?" he asked.

"Sure. Come on up with me."

Ariadne led the way up a narrow ladder that wound its way around the side of the tank to a small platform at the top. Then she went over and opened the trap door into the vat. It was a fairly complicated business for the door was built like an airlock on a space ship. Leigh looked inside and saw a rope work ladder that dangled into the abyss.

"Better take off your shoes before you go down," Abbie said as she lowered a light on the end of a long cord into the opening. "You can't imagine what a fuss Daydala



puts up over the slightest scratch."

Like spiders on a web, the two of them made their way down the swinging rope ladder. The bare light bulb showed a myriad of eerie reflections on the polished interior of the sphere.

"It's over ten feet in diameter," the girl said. "Isn't it fantastic? What an *environment* this would make in the sculpture annual at the Whitney!" She spoke softly but still her voice had an unreal, hollow ring.

"It *is* fantastic! Straight out of *Alice in Wonderland*," Leigh agreed.

"Not *Through the Looking Glass*, but right in it," Abbie smiled. "Look at those reflections."

"I see what you mean about scratches. I feel like I'm inside a Cadillac hood ornament."

"Do you believe me about my work now?" she challenged. "That's one helluva good piece of welding if I do say so myself."

"I couldn't agree with you more. How did you do it?"

Abbie started up the ladder, talking as she did in great technical detail about spherometers, buffing tools, Georg Jensen tricks she said she'd picked up in Copenhagen, and the other techniques she'd used to make the delicate surface.

Out on the platform again Leigh motioned to the two rings which circled the giant vat at an odd angle.

"Any idea what those are for?"

"No, but I think those wires go to some sort of electrical thing below."

"Maybe they have electrical coils inside the rings," Leigh speculated.

"Couldn't prove it by me," Abbie shrugged. "Well, are you going to tell me what it's all about, physicist? All this time I've been working, no one would tell me anything except that it had to be smooth inside. Now it's finished, I'd sure like to know."

"Finished? You're all done then? Does Daydala know?"

"I'll tell her when I get back, but she won't tell me anything. Will you?"

"I can tell you what I think it is. Is that good enough?" he asked.

"Well then, go ahead," she said a trifle impatiently.

"The rings I asked you about," John explained, "are probably Helmholz coils to neutralize the magnetic field of the earth. That long thing there coming into your vat is my solenoid which is another name for a long magnetic coil."

"And what's cryogenic—you know, like you were talking about before?"

"Cryogenic equipment is machinery for making really low temperature stuff, liquid air and the like. You know, things like they use to fill rockets with liquid hydrogen.

"And I think your vat is some sort of a liquid hydrogen reaction vessel," he continued. "It's actually

a very sophisticated piece of equipment."

"To do what?"

"That's a good question. To do some sort of complicated kind of reaction, I suspect." He decided to take a chance. "Have you seen anything around marked with a yellow and reddish sign that says it's radioactive, or say, something marked 'Property of the Energy Research and Development Administration' . . . anything like that?"

He waited tensely for her answer.

She thought a minute. "No," she said slowly. "How big would it be?"

"Oh, about the size of a small barrel."

"No," she said. "Nothing like that. Should I have?"

"If you had, I could perhaps get a better idea of what your father is up to."

"He's my stepfather," she corrected emphatically. "Look, I'm tired. Let's get out of here and go to my room. I can make us some coffee."

"That sounds fine."

They retraced their steps through the maze of the mine and back down to where they had left the Cushman plugged into a socket. She started towards the driver's seat, but Leigh beat her to it.

"You're tired. I'll drive this time," he said firmly, taking his seat. He waited for a stormy reaction about his male chauvinism, but she only nodded wearily and got into the passenger's side. She even let him drive the Toyota back to the Hall.

Ariadne's apartment contained one of those compact appliances which combine stove, refrigerator, and kitchen sink all in one. Soon she had a sleek Finnish pot set to boil and was laying a tray with mugs, spoons, and plates with thick chunks of cheese and piles of crackers on them. She opened a can of sardines and set the loaded tray on a low table made of a heavy glass top set on an intricately-welded bronze base that was more sculpture than furniture. Leigh relaxed contentedly on a down-filled leather sofa of the best design Denmark had to offer. Ariadne might call herself a starving artist, but it was obvious that she had the money to indulge her excellent taste in interior design. As he watched her move about the room, he decided that she went with her surroundings here—cozy, relaxed, but not starving—definitely not starving.

In a moment she brought over a pot of fresh coffee, some cream and a fifth of Irish whiskey. Without recourse to measuring, she dumped what appeared to be nearly equal amounts of each into the two mugs and handed one to Leigh. "Cheers!"

He tasted his and glanced in surprise at Ariadne. It was coffee-flavored whiskey more than it was

Irish coffee. "Cheers!" he answered.

"The coffee is to wake us up and the whiskey is to put us to sleep," she explained and piled a cracker with cheese and a sardine.

"I'll drink to that," Leigh leered at her cheerfully.

"Why?" she answered, all innocence, then abruptly changed the subject. "You know," she said, "you puzzle me. You don't fit in this place. You're too . . . normal, somehow."

"Gee, thanks, I guess. What do you mean, too normal? You make being normal sound freakish."

"But that's just it. You're a normal man among freaks. That's what makes you not fit. There's my rotten stepfather—he's a megalomaniac, for starters. When it comes to sex, he's AC-DC. One time it's Daydala and the next it's Alexi. He's got phobias coming out of his ears. There are those damn dogs, and this thing he's got about mazes and above all his determination to win at all costs. And if he needs money to get in the game, he gets it any way he can . . . any way," she repeated, her voice hardening to a tone Leigh had never heard her use before.

"And then there's Daydala. There's something wrong there. Have you ever noticed her eyes?"

"They're different colors, aren't they? " Leigh said.

"That's not what I mean. When I was working on the kettle, she'd get terribly upset if she found a leak or a scratch. She'd stare at me in a funny, fanatical way and say, 'It must be right, do you understand. It must be right.' One time she got so excited that she grabbed my arm when she said it. I was black-and-blue for a week.

"Alexi's a homo, but he's gentle enough. I think he's scared of the other two. I don't blame him. I guess I'm a little scared myself."

"Then why do you stay?" he asked. "You don't really fit either. 'Too normal' to quote my favorite artist."

"Because I have to. I'm not finished yet."

"Finished with what? The kettle is done now. Why stay with people you hate and fear?"

"Can you keep a secret?"

"Lots of them."

"Then keep this one or you'll blow it all for me. You see, I'm sure that Bull Tauroman murdered my mother. She'd had sadness in her life, of course—losing my dad like that and all. But her family and friends stood by her and helped her recover as much as possible. She was really a very stable woman, not a suicidal one. If she was found in a car with the motor running and the garage door closed, it was because she couldn't get out for some reason, and someday I'm going to find out what that man did to her so she couldn't get out."

"Why do you think he did it? If he did. Another woman?"

"My stepfather has only one reason for anything he does. That reason's money. My mother was very rich and I was as yet underage. If she died before I could claim my part of her estate, he was listed as executor and my guardian.

"Anne thinks so too, you know," she added with one of those abrupt changes she often threw into her conversation.

"Anne who thinks what?"

"I thought you said you knew Anne and Randall Durrell? They're my godparents and really like my family now. Anne thinks Bull killed mother. She's worried that he'll kill me too, but he won't because it wouldn't put any money in his pocket."

"He might kill you if you could prove he was a murderer."

"Perhaps." Ariadne paused for a moment and thought. Then she said, "It sounds as if you and Anne agree that I'm not safe here. So you think he's a murderer too."

"I don't know if he's a murderer or not, but I do know he's up to something and it's not good."

"It has to do with my kettle, doesn't it?" she asked with sudden insight. "Will my kettle help him do something horrible to someone? It will, won't it? I've worried about that. You do know what it is all about, don't you?" Her words rushed out accusingly.

Leigh looked at the concern in the girl's eyes and made a decision. He was sure now that she could not be a knowing part of the scheme which had injured Fredrick Holzman and killed Nathan Hunter. Her fear and hate of the others was too clear. He needed help. The kettle was finished. The petrons would have to be brought out of hiding soon. Another pair of eyes and ears might spot them if he missed. He decided to trust her.

"I know more than I've said up to now, but I didn't know where you stood."

"You're some sort of a policeman, aren't you? Then you can help," she said, her voice enthusiastic. "You can help me catch Bull for murdering my mother. Why didn't you say so?"

"I haven't," he reminded her, "you have." His voice was serious. "But I do have a job to do here. What I'm going to tell you from now on could possibly get us both killed if Tauroman found out you know it. Do you want me to continue?"

"Of course. I told you once before, I don't tremble easily."

She poured them straight, black coffee and settled down to listen.

Leigh spoke softly and clearly as he told the young artist the whole story of the stolen petrons, the near death of Holzman, the cold-blooded killing of Hunter, and what the finishing of the kettle could mean.

"But where do the Moroccans come in?" Ariadne asked when he had finished.

"I'm not sure yet, but I'm convinced that Bull and they were behind the destruction and theft of the Petronelli experiment."

Ariadne put the heavy, handmade mug down on the coffee table with a crash that nearly broke the heavy glass top. "I told you he was a bastard!" she said between her teeth. "He's gotten away with a lot, but he won't get away with this. Why have you told me? What do you want me to do?"

"The main problem is the missing petrons. They have to be found before your kettle goes into action. They're hidden now, but to activate the equipment, Daydala will have to bring them out into the open. I figure that when they do that, I'll get them back somehow."

"But they'll have them heavily guarded, won't they?" She looked skeptically at him.

"Not if they feel as confident as I think they do that their secret is safe. And of course it is. Only you and I know that this whole scheme hinges upon stolen government property and what that property can accomplish. That's why I'll need your help. How about it? Are you game? You know the risks involved."

"You're asking me if I want to stop one of Tauroman's stinking schemes. I'd take risks a lot bigger than those you're offering to do just that. What do you want me to do?"

"I'm counting on the element of surprise. I'm planning to make a move as soon as I see the vat. Then it's a question of getting it out of the mine. You know the layout down there better than I do. Got any suggestions?"

"How big is the vat?"

"About the size of a keg or small barrel."

"Heavy?"

"Not for the two of us together. It has large handles on both sides."

"Then I'll bet we could . . ."

Leigh nodded as she spoke, sketching out her idea in the air with her hands. It was, with a few minor changes, the same plan he had in mind himself.

"Remember," she concluded, "that old shaft comes out right into the field where Pride of Knossos is pastured. He knows me, but he's a bull and a big one. I'll have the bus I use for transporting sculptures parked right outside the shaft opening so Pride won't get too much of a chance at us. Since it's a familiar sight around here, no one will notice the bus much, I hope. How does it all sound to you?"

"It sounds to me like you're a very clever young lady. I say this," he grinned at her, "because except for your bus, which I didn't know about, it's almost exactly the same as the plan I was going to propose to you. Now, I'll have to get all of this information to my contact tonight. I've got to get past those damn dogs and get off the island."

"I left the Toyota right by the

back door of the Hall. Everyone knows that I work at night. I'll drive you to the elevator shaft and go back into the mine with you. If I see Daydala and her crew, I'll say I lost my watch or something."

"Good. I'm going to try getting out by way of the deserted shaft we'll be using when we put our plan to work. I want to test the feasibility of using it. Besides, I want to avoid that snoopy gatekeeper."

"I don't blame you. He's a nosy creep and tells everything he sees. What will you do once you're off the site?"

"Get over to the highway and hitch a ride to a pay phone. Say," Leigh suddenly remembered, "you said that old shaft opened into Pride's pasture. What kind of trouble can I expect there?"

"None. The bull's usually in the barn at night. But how will you get back? Do you want me to wait for you?"

"No. I'll stay out all night and mingle with the workers coming in on the morning shift."

"Okay," she said, getting up from the couch and stretching her long body. "Let's go then. Ready?"

"Not quite," he answered. "I have some unfinished business on my mind. There's still the whiskey part of your Irish coffee to attend to."

"Whiskey?" she asked. "But I just tanked up on black coffee. I can't even feel the whiskey."

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"But I still can. Come here."

Some time later Ariadne opened her eyes and said in a lazy, teasing voice, "Mmmmm, nice. Do you think you could get arrested for contributing to the delinquency of a minor artist?"

"Not a chance, honey. You're a major artist in my book."

"Gee, thanks. Maybe you ought to let *Art News* know. Well," she said, sitting up straight on the couch and clapping her hands to her knees, "enough of this. Are you ready *now* to go back to the mine?"

"I guess so," Leigh grumbled. "Work! Work! Work! All you women think of is driving a man to work."

"Oh, I wouldn't say that," she

said, rumpling his already unruly hair. "Unless, of course," she added, "you think everything is work."

"Ms. Boulton, you are a tease," he told her as she jumped up from the couch and tried to duck away from the slap he aimed at her trim behind. "Come on. Let's get going. I'll be up all night as it is."

The yellow Toyota coupe was not where they had left it when Leigh and Ariadne came down to the courtyard behind the breakfast room. They could see, in the dark shadows at the end of the areaway, that one of the other cars, a blue one, was parked in the small carport there. Ariadne frowned.

"Rats! Someone must have gone over to the elevator while we were upstairs. Who do you suppose it was?"

"I don't know. Does Daydala go over and check your work when you finish each night?"

"Well, she usually meets with me in the morning for a progress report, but I know lately she's been getting more and more impatient to have the thing finished." Ariadne glanced at her watch. "Maybe she decided not to wait until morning."

"We'll have to watch our step in any case. I don't want to run into anyone tonight if I can help it."

They moved quickly to the blue car and drove it to the elevator building. Everything seemed as deserted as before, but Leigh noticed that the elevator was at the bottom of the shaft. He had to call it up. And the extra Cushman electric car next to which he had parked when they had come back from the mine earlier was now missing. Their voices hushed as they reached the heavy timber door. Slowly he pulled the door open and then motioned Ariadne for complete silence. She followed him into the tunnel and both looked above them in complete surprise. The lights in the tunnel were on. Someone was in there somewhere. Noiselessly they made their way to where the cross gallery to the laboratory turned away from the route to the old horizontal shaft. Ariadne pushed John in the right direction and laid his hand on the carved tiles. He nodded in understanding and, running his hand along the patterned indentations, moved off into the blackness of the unlit tunnel. He looked back in time to see Ariadne give him a thumbs-up sign and stride jauntily off down the lighted passage which led to the laboratory.

Now why is she going down there? he thought, worried. *The best thing she could do is get the hell out of here. She must be going to make good the alibi of her missing watch. I sure hope she knows what she's doing. Crazy female.* He paused to watch her go with concern in his eyes and a smile of affectionate memory. Then he turned and moved along the dirt path, his hand still on the cold, damp guide-

tiles. The way seemed, from the tensing of his legs, to be leading uphill. Suddenly his hand flew off the wall into nothingness and he realized that he had hit another cross gallery. He felt the tile around the corner. It was bare. There were no guiding arrows in the smooth, concave medallions. It was a dead end. He risked the small pencil flash on the other two possibilities and finally found the correct path leading off to the left. This passage ran even more steeply uphill. Feeling safe now to use his light, he moved more quickly and was soon at a timber door not unlike the one which blocked the entrance to the laboratory inside the mine. It too pushed open easily on well-oiled hinges.

He slipped through and paused for a moment, letting the cold, fresh air blow away the disturbing sense of claustrophobia the mine always gave him. Breathing deeply, he set off down the ruts of the deserted, old road. The dark hulks of the mushroom warehouses were on his left. To his right was the elegant white barn where the Pride of Knossos dozed, dreaming, Leigh supposed, of his satisfying chores fathering the fine Charolais calves for which he was justifiably famous and for which his owner received a very respectable sum of money. Below and behind him lay the white silence of the ice-choked river, black where the swift-moving water kept the channel open.

The passing hum of an occasional car beckoned Leigh to the highway and he hiked up the rutted road toward the blacktop, going over in his mind the plans he would relay to Silverman's man when he reached him. The walking became easier once he reached the blacktop. He turned left down the pavement and made his way across it to the shoulder where he tried to hitch a ride to the shopping center six miles down the road. He had covered about a mile of the distance when a truck driver with a large flatbed rig ground to a halt and signified his willingness to pick him up with a short toot of his horn.

"Thanks," Leigh told him. "Car trouble. Thought I'd try to phone for a tow from the shopping center down the road."

"Didn't see a stall on the road. Where'd it happen?" the driver asked.

"It's on a side road a mile or so back. Helluva piece of luck, on a cold night like this."

"Yeah. But I'm glad for some company. These night runs are too damn boring."

They chatted amiably about nothing until the driver pointed to the lonely, lighted telephone booth on the roadside near the shopping center. "There she is. Hope it works. Good luck."

Leigh swung down from the high cab and gave the driver a friendly wave of thanks. Then he strode

across the deserted pavement and into the phone booth where he dialed the number Silverman had given him. The phone rang and rang. Leigh drummed his fingers on the shelf under the phone and amused himself reading the graffiti on the walls of the booth.

Save water. Get dirty.

Pat loves Meegan and under that *Pat is a queer.*

He was musing on a rather unusual use of four-letter words in a particularly lewd rhyme just by the phone when a sleepy voice answered.

"Cyclotron."

"Is Cal there?" Leigh inquired.

"Not tonight."

Leigh heard the sleepiness disappearing from the voice as he repeated the phrases of the password.

"Then let me speak to Smitty."

"He's not here either, but I can take a message."

"I'd like to get over there tonight to get some work done. Have you got a car handy?"

"Yep," answered the voice, now fully awake. "Where are you?"

"At the Oakhill Shopping Center. Know where it is?"

"Sure do. Be about ten minutes. Can you wait?"

"Yeah. I'll be in the phone booth."

"See you then. I'll have a dark blue '73 Ford two-door," said the voice and hung up.

Leigh studied the limerick on the phone booth wall and was mentally composing one of his own when the nondescript auto drove up to the phone booth and a fresh-faced young man not long out of school came over to him.

"Dr. Leigh?"

"That's right."

"I'm Howard from the cyclotron."

"Okay, Howard. Let's go."

They got into the Ford and turned back the way the young man had come. The car wound quietly through the pleasant, rolling countryside and passed through a small, sleeping town.

"The America we once knew," Howard remarked, waving a hand at the neat, small shops lining the tree-bordered main street. "This is Saxonburg—famous for its annual volunteer firemen's parade and Washington August Roebling."

"That name's familiar. Wasn't he the guy who built the Brooklyn Bridge or something like that?"

"Well, actually I guess you'd say he finished it. His dad designed it and W. A. took over when the older man died. They were a pretty clever family of engineers. We studied them in my C.E. course at Case Institute."

They left the little town behind, chatting as they drove the few remaining miles about engineers and engineering they admired.

In a matter of minutes Howard turned the Ford off the main road onto a tree-lined drive which led past a rambling, darkened building

and ended in a group of quonset huts.

"This place is deserted now," Howard explained. "Used to be the transmitter for one of the big radio stations in Pittsburgh. After that Carnegie Tech built a cyclotron here with the help of the Atomic Energy Commission. It was a busy place for a while 'til research budgets got cut all over the place. Now I guess you'd call it a ghost lab. I've got coffee on over at the hut. You want some now, or do you want to make your call first?" Howard rambled on as he brought the Ford to a stop next to one of the quonsets.

"Let's get the call over first," Leigh said. "I'm afraid you'll have a guest for tonight and I'll have plenty of time for coffee after I talk to Silverman. I have to get back to Westpenn just as the morning shift comes on at seven."

"Great," replied the younger man enthusiastically. "It's been darned dull waiting out here to hear from you, but Silverman wanted to make sure you had all the help you needed. The direct line has been connected in one of the old offices over in the lab building. Come on. I'll show you."

"It's a twenty-four hour line, of course."

"You bet," Howard grinned ruefully. "The Professor called me up last night at 3 a.m. just to see if it was working alright. Doesn't he need any sleep at all?"

He unlocked a door at the end of one of the long wings of the rambling building and motioned Leigh to enter. Their voices echoed in a lonely way down the deserted, silent corridors. Rooms to the left and right of them were dark and empty, their once-busy equipment stilled and in storage. Leigh felt depressed. The abandoned laboratory seemed like a morgue for dead dreams.

"I'd heard that this facility had been shut down, but I never thought to use it for a rendezvous," Leigh remarked. "Good idea."

"It's just about perfect for the use," Howard agreed. "The direct line's in here."

Howard unlocked an office door and switched on the light. A typewriter-sized scrambler sat on the desk and the young man seated himself in front of it, manipulating buttons and switches until Silverman's alert voice came over the speaker.

"Silverman here. What's up?"

"Professor. This is John Leigh."

"Good to hear you, John. Have you found the vat yet?"

"No. But I think I know now where it's going to show up."

"Good! That's the news I've been waiting for. Hang on a minute. I'm going to get Petronelli in on this."

There was a series of buzzes and hums as Silverman manipulated his phone to arrange a conference call.

Soon a third voice sounded out of a gloomy fog.

"Petronelli here."

"Mario? Silverman here. I have John Leigh on the line and I wanted you to hear what he has to say. He thinks he's found the petrons."

Leigh heard Petronelli's sleepy voice mutter something about only pimply-faced adolescents making phone calls at this hour and didn't Silverman ever need any sleep. John smiled. Petronelli's own reputation for driving his colleagues all night when he was running an experiment was legendary in the physics world. Then the Italian wakened enough to understand what Silverman had just said.

"He's found them, you say? Are they intact? Where are they? When can we get them back?"

"No," Leigh corrected. "I haven't found them but I'm pretty sure where they're going to turn up."

"And what good is that going to do?" Petronelli asked, his excitement cooling as quickly as it had bubbled up.

"Perhaps you'd better tell us the whole story," Silverman suggested.

"Well, it begins with this welder and her silver kettle . . ."

Leigh went on to describe the silver tank that Ariadne had been working on and the huge, cave-like room in which it was built. He gave minute and accurate details of the contents of that room with its complicated scientific equipment, and where that equipment matched what he had been told to look for. Then he explained his plans for the removal of the petrons when they were brought from their hiding place.

The other two men listened in silence. John wound his story to an end and waited for a reaction. At first there was none and then Silverman said, "It sounds pretty shaky, just you and the girl. Sure you don't want some help?"

"No. We've got to rely on the element of surprise. If they suspect anything, they'll hide those petrons where we'll never find them, or worse yet, dump them into the Allegheny. It seems to me this is the best way."

"Well, I guess you know the lay of the land best. There will be a helicopter at the cyclotron site to cover you if you need help. Howard will give you red flares you can use to call for help if you need it. The chopper will be on twenty-four hour call. Can you think of any other way we can help?"

"Well, I could use some information from Dr. Petronelli about the mechanics of that silver kettle. I'm convinced that the silver tank is what you told me to look for, but I'm still a little hazy about how they'll use the petrons once they bring them out of hiding and what signs I'll have to look for to be sure that the thing is getting ready to run."

"Well, Mario?" Silverman asked.

"Hmm . . . yes . . . silver, of course." Leigh could almost see the small man running his hand over his wiry, greying hair as he collected his thoughts.

"Some of the best theorists I know have been working on the problem and they've come up with a fairly definite model. Could you describe the tank from the inside once more?" he asked.

John answered. "There was the hole where the pipe from the solenoid came in. Then there were gigantic electrodes like ten-foot-diameter wedding rings near the top and the bottom. Beyond the electrode near the top of the flask it sort of tapered in. I believe there was a large pipe going from there to somewhere in the ceiling."

"Ah. Very good." John felt as if he were taking his graduate oral exams as Petronelli continued. "Tell me, was there anything connecting the tank to the back end of the solenoid?" Petronelli's voice sounded intense.

"As a matter of fact there was. I guess I forgot to mention it. Looked like a clear plastic pipe with an electric cord wound around it."

"Yes. I thought there would be. Is that all you can tell me then?"

"I think that's everything."

"Well then, I think I can explain to you what your friends plan to do with my petrons. You see, petrons have a most intriguing property. Oh, nothing particularly fundamental, but sort of an extra bonus."

John could hear the pride in the physicist's voice as he discussed the particle he had discovered.

"Remember, petrons have both magnetic and electric charge. That solenoid can be used to give a petron a good healthy boot on the bottom and accelerate it, so to speak. A solenoid such as the one Mr. Tauroman has would give the petron more energy than the most powerful accelerator in the world.

"Now my guess is that your lady welder's tank will be filled with hydrogen and deuterium gas. Two things happen when the petron hits the gas. It stops pretty quickly and it may make another pair of petrons. The petrons latch on to parts of a hydrogen and deuterium atom and make sort of half-baked molecules. The interesting thing about these molecules is that the parts are so jam-packed together that they fuse."

"Fuse!" Silverman repeated. "Do you mean like nuclear fusion in a hydrogen bomb?"

"Absolutely," Petronelli answered. "The molecule forms helium—you note there is therefore no pollution—and gives the petron a little five-and-one-half-million-electron-volt kick by a process we call internal conversion."

"Are you telling me that Daydala and Bull have invented a way to fuse hydrogen that easily? Why, all the major powers in the world have

been trying to do that for the last twenty years."

"Daydala and Bull didn't exactly invent it." Petronelli sounded stuffy. "As a matter of fact a very similar process was discovered in a bubble chamber at the University of California many years ago. But of course, no one had found petrons then. The California experiment used another odd particle, the muon, so they called the process *muon catalysis.* A well-known theorist, Dave Jackson, even speculated on the economic possibilities as far as power generation. It wasn't practical with muons because the muon disappears after catalyzing only a few molecules. My petrons don't disappear."

"You see, John," put in Silverman, "as I understand it, the recoiling petrons heat up the gas and the hot gas is taken off from the top to run a turbine."

"Exactly," agreed Petronelli. "I imagine that Daydala designed those electrodes you said looked like giant wedding rings to set up an electric field to drive the molecules up to the top. That way she can probably get the bulk of the heating in the gas at the top of the tank. In the theoretical model my friends have designed, there is a pool of pump oil at the bottom to trap the positively-charged petrons."

"Does it also have silver walls? I still don't understand why silver and so smooth," John asked.

"Silver's diamagnetic, remember. That means it repels magnetic things like petrons. That way they stay inside the kettle. The walls are smooth so that they don't pick up impurities to which the petrons could stick. Your Daydala is a very brilliant lady, my friend. She seems to have thought of everything."

"Why were you so interested about that tube connecting the top of the kettle to the solenoid?" Leigh asked.

"I told you Daydala thought of everything. That tube is for recirculating the petrons. She collects them at the top and then pipes them around and gives them another kick. That way her charge of petrons keeps building up. We gauge she would need about a trillion petrons to perk a generator along at a megawatt. That sounds like a lot of petrons, but actually it's not hard to get at all. Once the generator is self-sustaining, she'll probably eliminate the solenoid altogether and just perk along without it."

"She said she'd invented something that would revolutionize the power industry and she meant it. The possibilities are fantastic. You can see why we've got to get those stolen petrons back. Once she revs that thing up there will be just too many petrons to keep track of," Silverman explained. "You've got to get that initial charge before they start operating."

Leigh sighed deeply. His task

suddenly seemed monumental. Before he could speak again, Petronelli's voice returned to the line. "We assume that this Daydala knows what she's doing, but if that petron charge builds up too fast, she'll have some heat on her hands."

"I hope you don't mean that we're fooling around with a hydrogen bomb."

"Not exactly. The petron charge could build up in one to ten seconds. Uncontrolled beyond that you could have a charge equal to, say, ten or fifteen sticks of dynamite."

"Great! That's just what we'll all need in an underground room with liquid hydrogen piped into it." Leigh sighed again. "Well, unless you have any more surprises for me, I guess that's it for tonight. This thing is coming to a head. You'd better have that chopper ready. I'm going to get some sleep."

"Good idea. You'll need it. Good luck, John."

They signed off and Howard, by turning a series of buttons, reduced the conference call box and scrambler to silence. Leigh looked at his young, serious face and saw in Howard's intent eyes a look he might have seen in his own years ago on his first assignment for SPI. Now he just felt tired and inadequate.

"Let's go get some of the coffee you offered before," he said to Howard.

Leigh slept almost immediately after a single cup of the warm brew and had to orient himself as to where he was when Howard shook him awake a few hours later.

"Dr. Leigh. Dr. Leigh. It's after six and you said that the early shift came on at seven. If you want to mingle with them, we'd better get going."

Leigh dressed and shaved with a borrowed razor, trying to shake the sleep from his brain with some more of Howard's coffee. They got into the blue Ford and drove quickly to the crowded parking lot where Leigh slipped from the car and without a backward glance merged with the chattering crowd of girls making their way to the main shaft of the mine.

The laboratory wing where he had his office seemed to be deserted when he got there. Daydala and Alexi were both gone and none of the technicians were around. A nagging worry began to gnaw at him, but then he dismissed it. He was up much earlier than usual. Perhaps they simply hadn't come in from breakfast yet. Then he noticed a message on his desk.

Dr. Leigh, while you were out Dr. Landry called. She requested that you meet her in her office as soon as you come in. She says it is most urgent.

Leigh frowned and made his way back to the main elevator and the third level. Dr. Landry and he had had almost nothing to do with each

other since their first meeting. What did she want with him now?

He knocked on the door of the mycology laboratory. No one answered so he went in.

"Dr. Landry?"

An inner door to a small lab opened and the tall, slim figure of Ariadne Boulton emerged, grabbed him by the arm, and dragged him into the cramped laboratory where stacks of glass bottles packed with rye grain and cotton lay in racks against the wall. Ariadne held his arm tightly and shook him in her excitement.

"Where have you been? I've been nearly desperate. They're ready, don't you see! We've got to do something."

Leigh looked at her in surprise. "I've been right where I said I would be. I told you I was going to report and then come back with the morning shift. Now calm down and tell me exactly what you've been up to. We won't get anything done if you lose your cool."

"Well, we'd better get something done quickly or your whole careful plan will be shot, because Daydala says it's ready. The kettle is ready and they're meeting at 7:30 to take what she said was the first run."

"How did you find out? Did she tell you?"

"I overheard it. After I left you last night I went into the laboratory to see what was going on. I found them all there—Daydala, Alexi, Yusuf, and all the technicians. I told her I'd lost my watch like I said I would. She quizzed me about the tank and I showed her what I'd done. She seemed very pleased and so did those others. She told them something about the time of the prophecy being at hand and that they'd have prayers in her room and meet again at 7:30 this morning to run up the machine. Now what the hell did she mean by prayers and prophecy and all that? Anyway, she really looked a little crazy, almost as if she had completely forgotten I was there at all. John, it's time. We've got to do something before it's too late or Bull Tauroman and his crew win another game." She was holding his arms and shaking him again.

"Okay, Abbie. Okay. I understand now. Seven-thirty, you said."

He looked at his watch. It was 7:15.

Just fifteen minutes to get his whole, shaky plan into operation. Ariadne looked at him with impatience as he called the cyclotron number. Would Howard be back yet? Leigh hoped so.

The phone rang.

"Cyclotron."

"Howard? This is John. Have you recovered from our wild night last night?"

"I guess I would if you'd let me get some sleep."

"Yes. Well, you remember that flighty little number we were talking about?"

"What? . . . Who? . . ."

Leigh closed his eyes and tried to will Howard into getting his message about the helicopter. The young voice was puzzled momentarily, then he seemed to catch the idea.

"Oh, yeah, her. Why? Do you want me to call her for you?"

"I sure do. What I'd really like is to have her right now. Hair-of-the-dog and all that. But do the best for me, will you? She really sounded like something."

"Okay. I'll get right on it. Man, you sure are a glutton for punishment. That all you called about?"

"I guess so. I've got to get to work now. We're starting earlier than I thought this morning. So long."

"Yeah. Well, hang in there. Good-bye."

Ariadne was almost beside herself by the time he hung up.

"Now why did you waste three minutes of our precious time? Making a date when the whole plan is . . ."

"Ariadne, my love," Leigh cut in gently, "shut up. Let me take care of my part of the plan. You take care of yours. Have you had time to get that truck of yours around to the shaft opening yet?"

The girl, arrested more by the tone of his voice than his words, ceased her scolding. "Yes. I brought it around at 6:30. I told the gatekeeper I was going to do some sketches of the castle from this side of the river. He doesn't know I haven't done a landscape in ten years. What will we do now?"

"Try to get into the laboratory and hide before Daydala and her men come back. Have you ever fired a gun?"

"I practiced on the rifle range at girl's camp. I even hit the target."

Leigh looked pained. "It'll have to do." He handed her a police revolver. "You may have to use this. Let's go."

They left the mycology laboratories and strode quickly down the hall where they forced a cheery "Good morning" to Dr. Landry just coming down to her domain. Level three seemed almost deserted as the workers had moved their harvesting operations to another part of the mine. Overhead, one of the color televisions showed Pride of Knossos ambling happily in his pasture where, they knew, a warm sun was giving the air a feeling of premature spring.

Several of the electric cars used in the mine stood plugged into the wall near the elevator shaft at the crossing of the corridors. Leigh's eyes ran rapidly over them and spotted one with the key in the starter. He unplugged the vehicle and got into the driver's seat.

"Come on, get in," he commanded Ariadne. "We'll need this to haul the vat when we find it."

"Okay."

She jumped into the car beside him and they drove down the pas-

sage that led to the closed part of the mine.

To their immense relief, the corridor behind the heavy timber door was dark. Apparently they had arrived before the Moroccans. Leigh handed Ariadne his small pencil flash. "Here," he said. "Hop out and guide me with this, will you?"

Ariadne had come this way so often, she remembered exactly the twisting and turning even in the dark. She moved rapidly and scarcely paused to check the tile markers.

In moments they were in the cavernous room where a few strategically-placed night-lights barely revealed the giant hulk of Ariadne's silver vat.

"Where will we hide?" Ariadne whispered, her voice hushed in spite of the fact that they were obviously alone.

"Up there on that catwalk that leads around behind the nitrogen tanks. I noticed it when you were working last night. It's in deep shadow even with the lights on. Let's go." He gave her behind a gentle push and was surprised to see her jump. It was then he realized that she was as nervous as a cat. *Don't go to pieces on me now,* he prayed silently. *You said you didn't tremble.*

It seemed to them that the hollow sound of their feet on the metal stairs of the catwalk would alert the whole mine to their presence, but the room remained dark and still. They huddled together, their bodies pressed as far into the shadows as possible. Occasionally Leigh felt Ariadne shudder as the tension of the waiting built. He looked at the luminous dial of his watch. It was only 7:29.

Suddenly his eyes blinked as the room was flooded with light and they heard a murmur of voices as Daydala and her crew entered the chamber.

Ariadne's strong sculptor's hand clutched his arm so tightly that he winced. He gave her what he hoped was a reassuring pat.

From their vantage point, they could see the tiny, dark woman and her band, all of whom they knew by sight. But what surprised them was the strange ritual they seemed to be enacting. Daydala had taken a stance in front of the men and had raised an arm, fist clenched, straight above her head. The men formed in a semicircle around her and, with one arm lifted to their foreheads as if to shield themselves from an intense light, leaned slightly backward from the waist. In this position, the woman and men quickly went through a brief liturgy in some dialect which neither listener had heard before. The two on the catwalk looked at each other, puzzled. Ariadne mouthed the words, "They're all crackers."

Leigh shrugged and turned his attention once more to the scene below.

The strange ritual completed, Daydala dropped her arm to her side and spoke to the men in English. "The Earth Mother has heard our prayers. The time of the prophecy is at hand. Start the pre-cool."

She walked over to the control console of the complicated machinery and began barking out orders to the waiting men. "Alexi, check those pressure gauges. Yusuf, start up the deuterium flow." The men scurried to fulfill her commands and, seated as she was upon the raised dais of the control console turning her dials, Leigh thought that she did indeed look like some sort of a high priestess. The image suddenly came to him of the strange gold medallion that Silverman had shown him. So that's what all that mumbo-jumbo was about. Some sort of a cult. As if he didn't have enough on his plate without dealing with a bunch of fanatics!

"Hell," he muttered under his breath.

Daydala's voice drifted up to them once again.

"Alright. That does it for the pre-cool. I'm going to turn on the liquid helium now."

She spun several knobs. There were a few clicks as the valves opened and then the sound of a tremendous rush of air.

Slowly the solenoid housing and the connecting pipes became encrusted in a thick layer of ice. Vapor contrails wafted up toward a ventilation shaft in the ceiling as the liquid nitrogen and helium pouring through the pipes chilled the air nearby so much that it froze.

"Is the vacuum holding?" Alexi called to his cousin.

"Perfectly," she replied with a grim smile that had nothing of humor or charm in it. "I am going to start the current in the solenoid now. Go and get the charge."

Leigh felt Ariadne move impatiently but he laid a restraining hand on her arm and quieted her with an almost imperceptible shake of his head.

The two of them watched, fascinated, as Alexi went over to the far wall of the cavern and stopped in front of the door-high cabinet of a fire closet containing a coiled, grey-canvas fire hose. Reaching out, he grasped the alarm handle nearby and pulled back. Slowly the entire cabinet pushed out into the room on long hydraulic jacks. Behind it on a shelf stood the vat Leigh had had described to him in such detail. Even from this distance he could read the large yellow letters stenciled on its side: PROPERTY OF THE US ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION—

Well, I'll be damned. No wonder Ariadne and I never saw it. It's a perfect hiding place. No one would dare pull that alarm for fear of bringing the whole mine running.

Again he had to salute the ingenuity of the small woman seated at the console in front of him.

The atmosphere in the room seemed to electrify as Alexi wheeled the petron vat over to the solenoid. Even Daydala appeared to tense as she attached the connecting cord to the instrument. Ariadne gave John's arm a violent shake. "Do something!" she hissed in his ear. "Aren't we going to do something?"

Suddenly into the tense atmosphere of the room cracked a commanding voice which boomed over the loudspeaker high in the wall.

"Alright, Daydala. Stop right there. The double-cross has gone far enough."

All the faces in the room turned as one to the small, brown box from which the sound had issued. Everyone recognized the voice of Clinton Tauroman. It continued to speak.

"So the machine is ready to run, is it? I thought so. You didn't know I have been watching you night and day over closed circuit TV. Did you think I wouldn't keep an eye on my investment? And did you think I couldn't find out that the last person to speak to the one man who could ruin me was a small, dark, beautiful woman exactly like you? The SEC served me with a batch of subpoenas late last night. That would not have been possible without the cooperation of someone who had all the knowledge of my affairs in her hands, or someone who could get it—someone, in fact, exactly like you. You tried to take me for a great deal, my dear, but you should have not tried to take me for a fool. You will stay exactly in the position you are in or my friend Hole will release the dogs which you can no doubt hear just outside the door of your laboratory. They are very alert this morning, and also very hungry. I shall be joining you in a few minutes."

The voice ceased. In the sudden silence a sound even more chilling than the voice drifted into the huge room—it was the snuffling and whining at the door of the powerful pit bulls which everyone in the mine knew and dreaded.

"Cousin Daydala. Cousin Daydala. What will we do? If he lets loose the dogs we'll all be ripped to bits," Alexi shrieked in terror.

Tauroman's voice answered. "Exactly, my friend. I'd hate to lose a playmate like you, but . . . the dogs are well trained, you know. Even I can't stop them once they are on the attack."

"Silence, both of you."

Daydala's voice cut into the air.

"A fool! You say I take you for a fool. And I say that you are a fool if you think that you are dealing with an ordinary mortal. Clinton Tauroman, we here are not ordinary mortals. We are the chosen ones. Chosen of the Earth Mother to fulfill a prophecy given in the

very Cretan cave you desecrated when you looted it of the golden treasure of the great god, Zeus. *There will come a time,* the prophecy said, *when the tribes of men will return to the worship of the Earth Mother. One of her disciples will discover the secret of the thunderbolts of Zeus and using them, will bring mankind to the feet again of my protectress, the Earth Mother. To only the chosen of the Mother shall this gift be given. So be it.*

"Thus spoke our great Zeus to the god-king Minos thousands of years ago. I, Daydala Pandarou, am that chosen disciple. I have discovered the secret of the thunderbolt. The Earth Mother will protect me and Her miracle. Your dogs can do nothing to me.

"Alexi, Yusuf, come. We have work to do," she said firmly.

But Alexi seemed not to have the courage of conviction his cousin had.

"No, no," he stammered. "I'm afraid. The dogs . . ."

And so saying, he turned, opened the giant door of the laboratory and fled. The others stared after him in horror. They heard the soft drawl of the mountain man speak to the snarling dogs, and then a scream of pure, abject fear. One of the technicians had the presence of mind to slam the door shut while the dogs were occupied with their grim work.

The loudspeaker crackled with sound. It was the wild laughter of Bull Tauroman. "Does anyone else wish to challenge my pets?" he asked.

Daydala ignored him.

"Yusuf, take his place. The Earth Mother has no patience with cowards," she commanded. "We will start the machine."

"Now!" Leigh ordered Ariadne. "Cover me." He vaulted the iron railing of the catwalk. His gun was covering Daydala with its deadly gaze before the woman realized what had happened. She stared at him in surprise which froze into a look of disdain. He made an ineffectual-looking avenging angel, dressed as he was in crepe-soled sneakers and dark turtle-necked sweater. But this was work he knew how to do and neither his gun nor his gaze wavered for a moment.

"Leigh! Good for you. Hold her 'til I get there," the loudspeaker shouted as Bull completely mistook the SPI agent's intentions.

"So, Dr. Leigh," Daydala said, recovering her poise. "And what is your role in this little drama?"

"I've come to recover some stolen property. The government wants its petrons back."

"Petrons!" she exclaimed. "I presume you mean the charge. If they must have a nickname, I prefer to use *dayons.* I predicted them years ago. Petronelli only found them."

Leigh almost felt like laughing. Even at this charged moment the injured vanity of a scientist was fighting for recognition.

"I really don't care what you call them—dayons, petrons, they are still stolen property. I'm afraid you have no right to them." Still holding the gun on Daydala, he moved to the petron vat and with one hand began to uncouple it from the machine.

But before he could loosen the coupling, Daydala's hand flashed out to the console. "Tauroman, if you can hear me. Leigh, listen to me. There are several hundred people working in this mine. If I flick this switch, in seconds they and you will be blown to eternity. You will not have time to do a thing. You, Leigh, do you want their blood on your hands? By now you know the properties of dayon catalysis. You can guess what would happen if it were allowed to run unchecked. Turn your gun over to Yusuf or I shall turn the switch. Even if you shoot me, you could not stop me in time."

Leigh's mind raced quickly over the information Petronelli had given him the night before. How fast would the machine reach a critical point? And how dangerous was it? He glanced at the lines of liquid gas and remembered the Italian's words. *Fifteen sticks of dynamite.* Was it too much to risk in the cavernous limestone room? Could he dare toy with the lives of the scores of innocent workers in the mushroom caves?

Hesitating only a moment, he decided to try calling her bluff.

"Nonsense, Daydala. I know you can't blow the mine up. Petronelli says that the boiler might make a minor explosion but it would take a while to develop."

Daydala laughed scornfully. "Petronelli has not the knowledge I have. He doesn't know the parameters. Put your gun down or I shall throw the switch."

The two antagonists stared at each other. Leigh could see no sign of uncertainty or faltering in the strange eyes. Was it possible that Petronelli and his friends were wrong? He could not take the chance. He spun around and fired his gun with dead aim at the pipe connecting the solenoid to the vat. The shot went cleanly through the pipe. The precious pump oil containing the petrons started to spurt out onto the floor of the cave.

At the same instant he fired he saw from the corner of his eye a quick movement of Daydala's hand as she turned a switch. Then her decisive voice rang out to her followers who had remained transfixed throughout the whole tense moment.

"To the escape route. Quickly. We shall meet where we planned." So saying she lunged toward Leigh and threw a body block that would have done justice to a pro guard. The running force of the small body was so unexpected that it took him completely by surprise. In the moment it took him to recover, Daydala grabbed a small flask from

her desk and held it for a second under the gushing stream of pump oil. Then she followed her men out the heavy laboratory door and into the corridors of the mine.

Leigh and Ariadne were motionless for an instant as they absorbed the full import of what had just happened, then Leigh lunged for the console Daydala had just left. Frantically he turned switches and dials in a frenzy of activity, shouting over his shoulder to Ariadne as he did so.

"The pipe. Plug the hole in the pipe. Quickly."

"How?" she screamed. "What'll I plug it with?"

"Your hands, woman. Your hands!"

His worried eyes scanned the controls on the console. His hands reached toward dials, spinning them quickly counterclockwise. There were great rushings and caterwauls coming from the machinery but nothing like an explosion. Tank pressure on the indicators dropped gradually and he felt himself relaxing.

"Good girl, Abbie. I think we won't be blown to bits."

"Thank God! But what about my hands?" questioned the white-faced girl. "What will happen to my hands with this black stuff pouring all over them?"

"Nothing more than if you changed the oil in your car. Just scrub them good with soap and water when this is over. Now we've got to mend that hole and get these petrons out to the truck."

"But where's Bull? And the dogs? And Hole? Are they waiting for us out there?"

As if in answer to her question there came a shout from the hollow corridors of the mine. It was Hole's voice.

"Bull! What the hell took you so long? That bitch got herself loose and went runnin' off. What'll I do?"

"The dogs, damn your foolish eyes. Get the dogs after them."

"Quick!" hissed Leigh. "While they're busy with Daydala's crew let's get this tank moving."

He wrapped the pipe rapidly with black electrical tape, finished unhooking the vat and together they pushed it on its dolly to the laboratory door.

"Stay here," he told the girl. "I'll get the cart."

He sprinted to the spot in a small cul-de-sac where they had hidden the Cushman electric car and drove it round to where Ariadne and the vat waited by the lab door. Jumping off the cart, he helped her load the vat on the back of the Cushman and then shoved her towards the driver's seat.

"You'll have to drive while I hold on to the vat and cover us from the rear," he told her. "And for Pete's sake, remember this thing drives like a tractor and not an Alpha Romeo."

As Ariadne went to start the electric car a shout from Leigh stopped her. "Wait a minute! There's something I want to do."

He jumped from the cart and ran to the box of circuit breakers attached to the wall just outside the laboratory. "They'll have a tougher time finding us if they can't see us. We'll just leave them in the dark," John said as he threw the switches on each of the circuit breakers. He gropped his way back to the cart. "Okay. Let's go."

Leigh grabbed hold just as the girl took off with a jerk and headed off down the corridor. Over the hum of the wheels they could hear another sound. Somewhere down one of those unmarked corridors dogs were snarling a vicious attack. A scream of terror or pain mingled with the growls lent wings of fear to the driver of the sluggish electric car as it bounced over the uneven floor of the passage.

The depths of an unlighted mine are perhaps the darkest places known to man. The small headlamp on the electric car did little to pierce the blackness ahead. John jumped off the cart again and ran alongside, his fingers feeling for the life-saving markings on the tiles. The dark tamed Ariadne's race-driver's inclinations and she kept the car at a sedate and steady pace with the figure trotting beside her. There was no sign of Tauroman, Hole, or (except for the noise) the dogs. It looked as if Leigh's plan was going to work. His spirits rose.

Then his foot hit a puddle.

Water splashed up on his pants as he ran. Suddenly he realized that his feet and legs were soaked. *Now what the hell?* he thought.

"John, I seem to be skidding. What's the matter?" Ariadne asked in a puzzled voice.

"You're skidding because I'm a damned fool. The mine's filling up with water."

"Why? What does it have to do with . . . oh, no! The pumps! They were on those circuits with the lights, weren't they?"

"You guessed it. When I shut off the circuit breakers, I shut off the pumps too. And a mine as deep and as close to the river as this will fill up fast without those pumps going. We've got to get out of here before the water reaches the works of that Cushman."

Leigh quickened his pace as Ariadne accelerated the electric car as fast as it would go. Then, as it had the night before, Leigh's hand tracing the guide tiles flew off the end of the wall and into empty space. They were at the crossing of the corridors. "Whoa!" Leigh called. "I've got to find the way."

At Leigh's shout Ariadne slowed the machine to a halt. In the silence they heard a scream which froze them both for a moment. The dogs had claimed another victim. Then, puzzled, they listened as the tone of the dogs changed from snarls to confused half-whining.

"Something's going on down there. Shouldn't we go and help?" Ariadne asked haltingly.

Leigh shined his light down the corridor. "Not a chance," he said. "Look at the way the path drops off there. That part of the mine will be flooded in minutes. And we've got to get this vat out of here. The path's over there, if I remember right." He ran to the corridor leading off to the left and felt along the tiles of the passage. "Yes, this is it," he called, beckoning with his flashlight. "Come on."

She started the Cushman again and drove in the direction he showed her. They were going slower now. "It seems to be straining, John," the girl's voice sounded worried. "Is something wrong with the car?"

"Don't worry. It's uphill along here and that cart was never strong on power."

Slowly they pushed on. Except for the wet hiss of the Cushman's wheels and the splash of Leigh's feet, the mine was silent now. There was no sound from the dogs.

Then they heard movement far behind them and a voice swearing violently. Straining, they could make out some of the words. The voice was unmistakeably Bull's.

". . . stay there. Don't let one of those double-crossing bastards get away. Those bloody dogs'll have to take care of themselves. I've got to find Leigh and see what he did with that vat. If he and that stepdaughter of mine are on the double-cross too, I'll kill them both."

Their faces set, Leigh and Ariadne tried to will the slow-moving little car to move faster. They heard, from far away, a voice which might have been Hole's answer Bull's threat, then Bull shouted back.

"I know. I heard them pass by at the cross corridor. Don't worry. They won't get away either."

Leigh splashed on ahead, motioning the girl to follow as fast as she could. Suddenly the headlamp on the Cushman grew dimmer and dimmer and then went out. The soft splashing of the wheels on the wet floor faded into silence.

"John," Ariadne called in a soft, frantic half-whisper. "It's stopped. What happened?"

"It's the water, Ariadne. It's shorted the car out. Looks like we'll have to walk."

Before he could say anything more, a powerful, handheld searchlight beamed straight at them from far down the corridor picking up clearly the outlines of the vat on the back of the cart.

Bull swore violently. ". . . up here. I knew it," he finished.

Leigh took careful aim at the moving light. The report of the gun echoed back and forth in the rock-lined corridors. The light shattered and went out.

There was another stream of profanity from the man behind them,

then Bull's voice called to them. "So that's how it is, eh, Leigh. You're playing some game of your own, are you? Well, I'll see that you roast in Hell before you get away with it."

While the mine resounded with Tauroman's very explicit descriptions of what he would do to various parts of Leigh's anatomy when he caught him, the SPI agent called softly to Ariadne. "Come on, help me push this thing across the corridor and then grab the other handle of the vat. We've got to get a move on. Lucky it's not too far."

They jammed the Cushman in place across the narrow passage and then each took a side handle of the vat and, carrying it between them, struggled off again up the corridor. In the dark they banged frequently up against the rough stone walls, but they dared neither light nor conversation.

They could hear Tauroman's voice coming closer, then there was a thump and Leigh reflected that Tauroman in his travels had picked up quite a vocabulary. He grinned in the dark and silently saluted the final job the little electric car had done for them. Up ahead the faintest line of light showed under the timber door. The end was in sight.

Moments later they flung themselves against the door and pushed it open.

The sudden daylight was blinding and in the seconds they paused to let their eyes adjust to the change there was a report from inside the mine and a bullet zinged between them. Then another and another.

"Down!" Leigh yelled. "He's got a gun."

Then there was a series of thuds as the heavy timber door swung shut and the bullets smashed harmlessly into it.

Ariadne scrambled to her feet again and they half-dragged, half-carried the vat to the gaily-painted vintage microbus which stood just at the end of the road leading to the door. Ariadne pulled back the side doors and Leigh almost flung the vat into the cargo space.

"You drive!" Leigh told her, giving the girl a shove towards the driver's seat. "I'll cover us if he starts shooting again."

Ariadne loved her faithful bus, and never more than that moment when the engine caught on the first try. It roared with the exuberant, old-washing-machine racket familiar to Volkswagen owners around the world.

On a rise of ground not far away, Pride of Knossos raised his magnificent head and glared. He had been snooping happily in the dried grass showing between the patches of melted snow in the pasture and he strongly resented any disturbance in his domain.

"Oh, oh," Ariadne remarked. "I don't think Pride likes my bus."

"Don't mind him. Let's just get the hell out of here."

"But I've got to warm up the engine or she stalls."

"Okay, honey. But warm fast, will you?"

While Ariadne revved the engine, the great, white bull was moving restlessly toward the roaring, smelly intruder. Pride had paused ten yards from the bus and was making a great show of his displeasure when Leigh saw the timber door to the mine swing wide and Clinton Tauroman emerge into the daylight.

Leigh looked at the massive, bull-like figure standing in the unaccustomed glare of the morning sun and was shocked at what he saw. The normally immaculate financier was disheveled and soaking wet up to his waist. There were dark red stains on his soft grey wool shirt. His thick, silver-grey hair was falling over his eyes and he pushed it back impatiently with an unsteady hand. Emotion flushed his face and swelled the veins in his thick neck so that they stood out in strong relief. He seemed unsteady on his feet, but perhaps it was just the impact of the light after so long in the blackness of the mine.

Tauroman caught sight of the truck warming up and bellowed in anger.

"Goddamn you, Ariadne, you'll pay for this. That vat is mine.

"Leigh, do you hear me? I don't know what sort of games you're playing, but you won't win when you play with me. I need that vat and I'm going to take it back."

At the sound of Tauroman's voice, Pride of Knossos turned his attention from the noisy bus to this new interloper into his morning. In his pampered life, the bull had heard very little human shouting. The herdsmen who tended to his needs knew he disliked noise intensely and rather than upset the valuable animal, they took care to speak in normal tones when they worked around him. The bull lowered his head and pawed the ground warningly.

But Tauroman did not notice. He saw only the motley-colored bus and the last chance to retrieve his gamble. Losing for Bull Tauroman was simply not in his scheme of things. Even the possibility of failure never entered his mind. All he needed was to stop his bitch of a stepdaughter and her friend from stealing what was rightfully his and everything would come out right. He raised his gun to fire.

"Go!" yelled Leigh.

Startled, Ariadne let up on the clutch and rammed her foot onto the accelerator. The old bus bucked like a frightened horse and took off down the rutted, unpaved road. Tauroman's shot shattered the window just behind her head and passed harmlessly out on the other side.

Leigh looked at Ariadne's strained and frightened face and then back at the contorted features

of her stepfather. Tauroman raised his gun again and fired, but between the rough road and Ariadne's driving, they made a difficult target.

Ariadne heard the shot and called frantically, "What's happening? What'll I do now?"

"Just look straight ahead and keep driving."

Leigh reached out his window and got a shot away, but it missed its mark. It was even harder to shoot from the bouncing bus than it was to shoot at it. There was another shot from Bull and the bus took a wild lurch as a tire was shot out from under them.

A peal of triumphant laughter rang from Tauroman as he jogged up the road after the crippled bus. Ariadne struggled to keep control of the Volkswagen while Leigh got another shot away but it was impossible for him to aim at the moving figure from the joggling vehicle.

Then Bull stood his ground for a moment to get a better aim at the other rear tire. Leigh fired again—in vain.

At last, Pride had had enough. The cold air rang with the bellow of an enraged animal. Tauroman, for the first time, realized where he was. He looked up in time to see the white bull lower his huge head and charge.

There was no fear in Tauroman's voice as he ordered the beast to stop. There was only anger at this final act of insubordination by one of his minions. And then the mammoth animal descended upon the man. It was over so fast that Leigh had no time to react. The bull threw Tauroman over his head and then wheeled and charged again at the fallen body. With a look of distaste, Pride flipped the body over again and then turned and trotted away from the whole scene to the far end of the pasture.

Ariadne was so intent on her driving that Leigh had to shout at her to stop. She pulled the lurching bus carefully to a halt and shut off the motor.

"What's the matter?" she asked wearily. "Are we licked?"

"No, but I'm afraid your stepfather is. Pride attacked him. We've got to go back and see how badly he's hurt."

"Pride?" Ariadne asked, gazing back in surprise at the huge, docile-looking animal now standing calmly at the far end of the pasture. "Pride attacked him?" It seemed incredible now. The attack seemed to have drained the bull's anger away. He stood as far from the scene as he could, his back turned on them in lordly disdain.

John and Ariadne ran from the bus to the prone figure of Bull Tauroman and knelt by his side. Tauroman was conscious, but his eyes were glazed with pain and he seemed not to recognize them as they leaned over him.

His lips were moving and Leigh slipped an arm under the injured

man's head and leaned closer to hear.

"The Old'un got 'em in the mine . . . I'll get 'em out here. We'll win . . . just wait . . . dirty, double-crossing bitch . . . can't beat Bull Tauroman . . . he takes what he needs."

Before Leigh could stop her, Ariadne bent over the man and spoke intently.

"And your wife—my mother," she asked. "Did you take what you needed from her?"

"Just the money," Tauroman mumbled. "Needed the money . . . she wouldn't give it up."

"Her life. Did you take that too?"

"Couldn't get one without the other." His voice became unexpectedly strong in spite of the effort his justification cost him. "She didn't understand. I needed the money to get in the game. Can't win if you're not in the game."

Tauroman looked fiercely at his audience, determined that they should agree. Then his eyes went out of focus and the massive head cradled in Leigh's arm lolled heavily to one side. Bull Tauroman was dead.

In the silence of the frosty morning, Leigh became aware of a new sound—the beating of a helicopter's rotors coming close. Glancing up he saw the aircraft making its clumsy way toward the pasture. Leigh reached down and gently helped Ariadne to her feet. As he turned her toward him, he realized that she was unaware of the approaching helicopter and even of him. The girl's face was set into the mask of frozen rage he had seen so fleetingly when she had first told him of her mother's death. Her voice was barely audible above the clattering of the descending rotors but the words were distinct.

"That bastard!" she said softly. "That dirty bastard."

The books in the library of the cyclotron had been removed when the facility was closed down, and the room had a barren, unused look about it that was depressing. Besides, Leigh found that he always had this feeling of letdown and dissatisfaction after one of his assignments was completed. He glanced at the woman standing next to him to see if she seemed to feel the same way. Ariadne sensed his attention and smiled at him. She looked a little older today for some reason, perhaps because he had never seen her dressed in a skirt before.

"How do you like my 'lady clothes'?" she asked him. "I guessed if I had to meet all those Washington bigwigs and hotshot *physikers* of yours, I'd better wear my one establishment rig."

He took a closer look. The tailoring of the soft wool suit fitted her tall body as only an example of fine Parisian design could. She seemed elegant, efficient, serious.

"You look great—different, somehow."

"Different! Well, all I've got to say is that damn well better be a compliment or the poor soul who designed this thing'll probably go out and shoot himself."

"Actually," Leigh admitted a little sheepishly, "I was thinking about that white sweater you always wear. I guess I miss it."

"The story of my life," she shrugged. "I spend a month's studio rent on this outfit and he prefers a sweater I picked up in a resale shop."

Silverman's entrance saved John from trying to get his foot out of his mouth. "Miss Boulton, how elegant you look today. I'm certainly pleased that you could take time away from your work and family affairs to join us for this meeting. Dr. Petronelli wanted particularly to thank you for the role you played in the recovery of the petrons.

"Morning, John."

There was a scrunch of gravel on the drive and a slam of a car door. A burst of exuberant tenor floated down the hall, and soon Petronelli himself strode into the room.

His attention fastened at once on Ariadne Boulton. "Silverman, you must introduce this lovely lady to me. Is she the one who was so important to the rescue of our small vat?"

"Yes, Mario. This is Ariadne Boulton. She . . ."

Petronelli immediately swept Abbie's hand to his lips. "I shall always be in your debt, my dear. I had no idea that a lady so clever would be so beautiful as well."

Leigh, for whom Petronelli at close range was a new experience, looked on with a twinge of jealousy. But then the Italian turned to him. "And you must be Dr. Leigh. May I say how much the world of physics owes you? And how grateful I am for your work?"

"Thanks. I'm sure glad we could get the vat back for you. Is Dr. Holzman better? I understand he's had a pretty rough time of it."

"Much better. In fact he's here in the laboratory right now running some tests on the contents of the vat . . ."

More participants in the meeting were drifting in now—Howard, George Kaplan, and finally the archaeologist, Durrell. Silverman seated them all on the hard, plain wooden chairs drawn around the library table which had only that morning been cleaned of its covering of dust for the occasion.

John Leigh looked up and smiled with pleasure as Emily Parkway came in carrying a tray of hot coffee and sweet rolls. Silverman introduced those who did not know her to his indispensable secretary and then called the meeting to order.

"This has been," he began, "an unusual and disturbing case for Science Processing. Through the ef-

forts of our agent John Leigh and the invaluable help of Miss Boulton here, we were able to recover the vat of petrons which was stolen from your experiment, Mario, and we owe them both a debt of gratitude.

"In addition, we have met here today to try to clear up any loose ends which may still be dangling so that the final report on this operation can be written. I will remind you that what you hear here is confidential and that it should not go further than this room. With one exception all the people in this room have been cleared . . ." He caught Ariadne looking at her "Uncle" Randy in surprise. "Dr. Durrell was with the OSS during the War," he explained, "and Miss Boulton's intimate association with the case was such that we felt that she should be present. We trust her discretion.

"In reviewing this case, we should perhaps begin, for the benefit of Dr. Durrell and Miss Boulton, with the discovery of the petron. I think that Dr. Petronelli can best describe that. Mario?"

"You wish to know about the petron, eh?" Petronelli began, and went on to explain, in his slightly pompous way, the properties and possibilities of his valuable discovery.

Ariadne looked over at John. *He looks as if he understands what that sexy little man is talking about. God! I wish I did.* Then some words of Petronelli's caught her attention again.

". . . more powerful than the atom bomb—the anti-matter bomb."

Why, she thought, *would anyone need anything more powerful than an atomic bomb? It would seem enough* . . . But before she could organize her thoughts on the subject, Silverman's voice drew her away from them.

"So now you have the background of the petron, its discovery, and the robbery of the vat containing the only examples in the world. We will go on to the reason for the presence of Mr. Kaplan in this discussion. Mr. Kaplan is a Commissioner of the Securities and Exchange Commission. The SEC became involved in the case from an angle other than the scientific one. George?"

Kaplan rose from his seat and cleared his throat. He was one of those lucky men who simply looked important in some indefinable way. Perhaps it was the complete self-assurance in his bearing. Certainly the quiet (and obviously expensive) good taste of his tailoring did not detract from the impression. He was the kind of man who made the perpetually-rumpled Leigh feel as if he'd forgotten to see if his socks matched. The Commissioner ran a hand over his already flawlessly-combed black hair and began his report.

"Our interest in the case started

when one of our market surveillance people called our attention to unusual movement in power company stocks. We watch such things for signs of manipulation and take spot checks to see that the laws governing these dealings are complied with.

"Acting upon information—a hunch really—from one of our staff members concerning unusual movement in electrical utilities stocks, we sent out an investigator."

Kaplan went on to explain, in what he thought were quite clear terms, the complicated dealings Bull had had in what he dryly called "Mr. Tauroman's power play."

"But unfortunately, before our man, Nathan Hunter, could process the papers of the informant we now know was Daydala Pandarou, he was killed."

"Hunter?" Ariadne blurted out as Kaplan paused to wipe his glasses. "The 'Incline Murder' victim was an SEC investigator?"

"He was indeed," Kaplan replied. "In fact he was coming from the meeting with Dr. Pandarou when he was shot.

"From the information we found with his body, however, we were able to document massive circumvention of the law by Mr. Tauroman—enough documentation, we felt, to convict him. In fact, we had served a subpoena on him late the night before the horrible incident which took his life."

Leigh glanced over at Ariadne during this discussion of her late stepfather. Her face was set in the same stone-hard expression he had see only two times before—once when she discussed her suspicions about her mother's death, and again when Tauroman had confessed to his part in it. He frowned. That hard, unhappy look did not belong on those sensitive, gentle features. Would time erase it? He hoped so.

". . . we come to Dr. Leigh." Silverman's voice brought him back to the business at hand. "John?"

The SPI agent went quickly over his part in the drama—the growing certainty that his suspicions about Daydala and Tauroman were correct; futile, hurried searches of the mine about which even Ariadne was hearing for the first time; and finally a description of the accident in the pasture. He tried to spare Ariadne's feelings as much as possible, but the fact remained that it had been a gruesome scene.

Durrell, hearing the full story for the first time, shuddered. "That's terrible. Terrible! No man deserves to die like that."

To everyone's surprise Ariadne turned on him, her face lit with fury. "But he did, he did deserve to die like that. He deserved to die like that a hundred times over. He murdered her, Uncle Randy. He murdered my mother just like Anne and I said all along. He admitted it there in the pasture be-

fore he died. He admitted it!"

The stony look was gone from her face now, and so was the fury. It was now simply the mournful face of a girl, streaming with tears. "And I wasn't even there to stop him." She put her face in her hands and wept.

Durrell put his arms around her and spoke apologetically to the sympathetic faces around the table. "Please excuse us. This has been a terrible strain on this young lady."

Emily Parkway had jumped up from the seat where she was taking notes of the meeting and helped the archaeologist to guide the girl from the room.

Silverman shook his head as he watched them leave.

"Why does a man like Tauroman function the way he did—murder, manipulation, robbery? He already had all the money a man could use. He had power, style, intelligence. He could have used it all to create something far better than this disaster."

"I guess it's rather an old-fashioned word," Kaplan answered, "but it's still around."

"What is?"

"Greed. Nothing was enough for him. He had to have it all."

"I suspect you're right," Silverman agreed. Then he became businesslike again as Durrell and Emily returned.

"Is Miss Boulton alright? I'm sorry that we upset her so."

"She'll be better in a few minutes," Durrell replied. "She's normally very strong, but her mother's death affected her deeply. She felt somehow responsible for letting it happen. She feels badly that she disturbed the meeting and asked that you go on without her."

"We understand. I feel at fault for upsetting her. I should have realized the strain she's been under. We'll try to finish up as soon as possible so that you can get back to her."

But John Leigh thought to himself with more insight than he knew he had, *Let her cry. Maybe it'll wash away that hard look for good.*

Silverman was still speaking. "Howard, you have a report on your search of the mine. Let's have that now. What did you find?"

"Well, it was pretty bad. I'm just as glad that Miss Boulton doesn't have to hear about it all.

"We got the emergency pumps working pretty fast and were able to get in to turn on the electricity for the pumps Dr. Leigh had shut off. We found five large pit bulldogs. Three had drowned. Two were cowering in a dead-end room of the mine. They had managed to get to a spot where the water wasn't too high, but the dark and the flooding had them pretty well confused. Even then, we had to tranquilize them to get them out of the mine. Those were the meanest animals I've ever seen. The two we saved were nearly berserk. Prob-

ably ought to be destroyed.

"We also found the bodies of seven men. They had been trapped in a cul-de-sac in the part of the mine where the flooding was the worst. What the dogs had begun, the water had finished."

"Did you say seven?" Leigh interrupted.

"Yes. Six were slight, dark men. The seventh was a tall fellow, extremely thin. There was a rifle near him of the same caliber as the one that killed the SEC investigator, Hunter. We're giving it ballistics tests now."

"I know who that thin man is . . . er, was," Leigh explained. "Hole Jones, Tauroman's dog trainer. Wouldn't be surprised if your tests check out. Jones would have done anything for Tauroman.

"But where did you find Daydala?" he continued.

"Daydala who?"

"The woman," Leigh answered impatiently. "The one who invented the power generator. The one who double-crossed Bull. The one who started this whole mess with her crazy religious ideas. There's only one like her—small, dark, with eyes that don't quite match, and long black hair. You know. What happened to her?"

"I don't know. We didn't find any women in the mine, and believe me, we gave it a good going-over. We found a small tunnel that led almost straight up out of the room where we found the bodies. A very agile, small person could have made an escape through that if they had known where it was and had avoided the dogs. But they'd have to be in good condition and want like hell to get out of there. None of our men could make it. Too big."

Leigh remembered the body block Daydala had thrown him as she ran to catch some of the precious pump oil in that small flask.

"She was in good condition, all right," he conceded. "And as for desire to get out . . . she was on some sort of a miracle kick. She thought she was chosen by what she called the Earth Mother to fulfill a prophecy that everyone would end up worshipping Zeus again. She was a fanatic and that sort of thing can make some people think they can fly if they have it badly enough. She did."

"Earth Mother?" Durrell put in with a puzzled sound in his voice. "I'd heard that there had been a revival of the old pantheism with an emphasis on some sort of an Earth Mother goddess-figure. Sounds almost like she was talking about the Cretans who worshipped Zeus and revered a goddess that wore a seven-tiered skirt and snakes. She's sometimes pictured with a rod in her hand like this." The archaeologist raised his fist directly over his head.

"But that's what she did," Leigh exclaimed. "Just before she started the machine going, she made that

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gesture. All the men gathered round and held their hands up to their eyes like this."

"Well I'll be damned!" Durrell swore. "That's straight out of Cretan mythology. So she thought that she was . . ."

A tap on the door interrupted his sentence and Emily went to see who was there. The thin, ascetic face of Fredrick Holzman appeared round the door and his diffident voice announced, "Excuse me. The tests are finished if you want the results."

"Come in, Dr. Holzman," Silverman invited. "I'm afraid you've missed quite a bit of the background of the meeting. Of course you can pick up most of it later in the report. But we do need your results to complete the picture."

"Thank you," answered Holzman. "But please continue. I didn't mean to interrupt."

"Dr. Durrell was explaining to us about an unusual religious cult it seems we may have been dealing with in this case."

"I remember now," Durrell continued. "You sent me that gold medallion awhile back to identify. It had the Cretan palace script on it. So that's what it was all about.

"This will take some real study," he mused. "It sounds like some sort of a straight religious throwback. Very interesting."

"Perhaps you can look into it further and send us a report. The story isn't really complete until we know more about this religious thing than we do.

"Now Dr. Holzman, what's the news on the contents of the vat?"

Holzman's brow creased into a frown. His discomfort at speaking even to a small a group as this was so painfully evident that it was easy to see why he and the voluble Petronelli made such a complementary pair. He rubbed his thin jaw self-consciously.

"Well Mario, how many petrons would you say were in the vat when it was stolen?"

"I always estimated six to eight," Petronelli answered.

"So had I," Holzman took off his gold-rimmed glasses, carefully wiped them, and stared near-sightedly at the ceiling.

"Perhaps," he continued thoughtfully, "there is something wrong with that portable tester we brought here."

Petronelli nearly rose out of his seat. "What do you mean something wrong with the tester? Where are the petrons? Aren't they there?"

Holzman turned to his friend in surprise. He carefully put his glasses back on and answered Petronelli in a mild voice.

"Of course they're there. I only meant I was surprised. The counter shows there are seven hundred and fifty-two of them."

The physicist looked benignly around the room with a slight hint of a smile playing at the corners of his mouth.

Silverman let out his breath in a hiss of surprise. "So it worked. Dr. Pandarou's petron boiler worked. She'd already gotten a multiplication of about a hundred." He turned to Leigh who had a distinctly startled expression on his face. "Lucky you moved fast down there, Leigh. Looks as if that boiler could have meant real trouble if you'd made a mistake."

"Oh, I think not," Petronelli replied airly. "At that rate there might have been a little heating, but the boiling would have cut it off quickly enough.

"And now that we have the petrons back, we can set to work applying them to the benefit of mankind . . ."

Before Petronelli could continue what threatened to be a long and flowery speech, John Leigh, normally the most polite of men, cut him off in mid-sentence.

"Dr. Holzman, one more question, please. What is your opinion of the number of petrons which spilled out on the floor when I shot the hole in the pipe? Were you able to determine that in any way?"

"Yes. Mr. Howard took me out to the mine this morning after the water was drained from the laboratory. The oil that spilled on the floor was washed away by the flood, but there was a splash on a cabinet top which was above the water line. I checked this with the tester which I had brought along. There were three petrons in it, assuming, of course, that the tester was accurate."

"But what does that matter?" put in Petronelli, still a little ruffled at having his histrionics cut short. "With over seven hundred of them to work with, the loss of a few petrons is surely negligible."

"That depends," Leigh answered him gravely, "on where they were lost."

Silverman suddenly realized the import of what his agent had just said. "Daydala Pandarou. The flask she filled with pump oil. Dr. Holzman, what are the chances that she could have caught some petrons in that flask?"

"How big was the container?"

"John?"

"About eight ounces."

Holzman considered calmly, then he spoke.

"There's very little doubt that she got several in that case. It would be a good idea to get them back. I'd like to check them out."

There was silence in the little room. The slight, blond man looked around him, puzzled. He had assumed that everything was under control. Why, he wondered, was everyone looking at the agent, John Leigh, like that when the man had done such a good job for them recovering the vat of petrons? Even Petronelli, who owed him so much, looked stern.

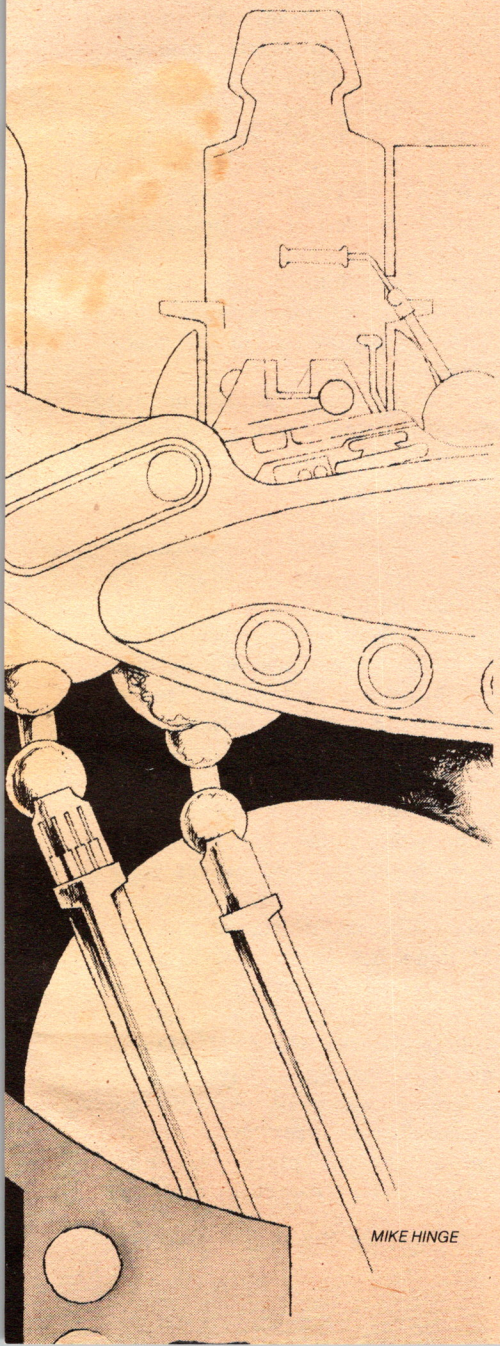
Finally Silverman spoke.

"Well, John . . ." he began. ■

FLY

A revolution is, above all things else, a state of mind.

MAL WARWICK



MIKE HINGE

Today the starship *Nôva Vida* departs for Capella.

That, my Sister Eugenia—that speck of glitter in the holocube—is the fruit of our Revolution. Are you watching, *hermanita?* There in the comfort of the Bishopric, are your eyes on the 'cube, your mind on the meaning it holds?

Consider: Mariano Bagua's ship is the fifth and greatest of the ramjet ships, with a scoop two thousand *kilometers* wide, and housing for three-and-one-half *million* people for the century of its journey. Now, in the gloom of space beyond Ceres, in the final moments before it leaves forever, the *Nôva Vida* orbits the distant Sun—the same Sun which bakes these drought-stricken valleys of Mariano's ancestral home.

If you are watching now, watch: a network jetty scoots into position a hundred kilometers ahead of the ship, its huge wide-angle holocameras slowly panning the ramscoop. One full circle, three hundred sixty degrees, but they fail to encompass the whole of Mariano Bagua's scoop! This is the scoop which will suck in the stuff of space to feed the fusion reactors to force out a stream of positive ions which will drive the *Nôva Vida* forty-five *light-years* away.

But listen: the launch may be slightly delayed, a smooth-talking newswoman says.

The network cuts to the agency's Earthside facilities, near Manaus on

the Amazonian plain. Among the fifteen thousand technicians who labor in that cavernous room the signs of strain are abundant, for all that the newswoman's voice is cool and detached. Their faces are unreadable from the distant perspective the cameras offer, but do you see how they crouch over screens and keyboards? Do you see them scuttling through the aisles of the world's largest single room?

Unseen and unnoticed among that host of technicians is Mariano Bagua, second assistant to the deputy leader of Green Team in the section called Group Fourteen. His teeth will now be tightly clenched, the perspiration rolling down the smooth brown skin of his forearms, a rasping cough suppressed in his chest. What he does and what he has done will help to ensure that the ramjets may continue to function two hundred *years* in the future.

Yes, *hermanita,* Mariano Bagua is there somewhere: a diminutive figure in a holocube in the eyes of an aging priest . . . in the rectory of an adobe church just off the plaza in an Andean village called Pichicaihua.

Can you grasp it all, my Sister?

Pichicaihua is two thousand kilometers from Manaus, as far as the ramscoop is wide!

This is the arithmetic of our Revolution.

And here outside my window in the dim light of dawn is the village Mariano left to launch his ship to the stars. Chill winds from the north are tumbling down from the pass, skipping like the feet of a mindless giant over the arid tribal lands. Dark smoke from the women's cookingfires snakes upward from most of the cinderblock homes which huddle around the plaza. Two children are leading a scrawny cow and three or four sheep to pasture up on the grassy *páramo* . . .

. . . and *there:* old Rufino, hat pulled low and striped red ponchos flowing, is emerging from the cornfield behind them, trudging across the sand.

He comes after all, *hermanita!* After nine years of silence, he comes! Perhaps not in celebration of the awesome ship his son helped to build . . . perhaps only to share his bitterness and defeat, to reproach me with his presence . . . but whatever the reason or pretext, he comes.

You cannot know the joy and apprehension that war within me now, *hermanita.* You cannot grasp what this means, because soon I, too, will leave Pichicaihua, much as Mariano has left it. I will leave Rufino and his defeats, and my own as well—leave these barren valleys for the world of Manaus and its self-conscious ways.

Yes, one day all too soon—tomorrow? next week?—you will fly in to take my place, my eager young Sister Eugenia, and our

Bishop's will will be done.

And what can I say to you when you arrive? How can I explain Rufino and the decade of silence between us? How can I make you understand what you see in the 'cube today?

Mariano was eight or nine when I met him, all grin and dust-caked ponchos. Like so many in Pichicaihua, he was slight and sickly from the bugs in his intestines and lungs, but only he of all the children who played in the plaza that year was unafraid to come here to the rectory—this cramped little nest of the wild-eyed priest and the shiny new 'cube and the ominous silver machines.

He would sprawl on the lounger and fidget, wiping the long black hair from his eyes, and the questions would come gushing out:

"Does the sheep bleat because it is sad, *hermanito?*

"Why do the old ones fight when they drink?

"Does the fly see the world as we?"

But I too was young—still barely fifty—and full of the faith of the Revolution, and for all the questions there were answers, ways to anger and arouse.

The *Revolution* was the answer—the Revolution that had made of our unchangeable Church an agency of change, the Revolution that was undoing what centuries of senseless wars and overpopulation had done. It could even—I *knew* it—change Pichicaihua, could fan the fires in those restless black eyes.

"Does the fly see the world as we, *hermanito?*"

"For all his wings, Mariano, the fly cannot fly as we."

Oh yes, we would soar! No manner of illness or doubt could stop us! If there were questions the priest himself could not answer—well, plug in the headset, switch on the terminal, key in the code for the sacred words and magical numbers!

If Mariano's father's weaving shop could no longer compete with the textile plants in the city . . . if the cornfields were barren and cracked . . . if tuberculosis were endemic, and dysentery and syphilis, and the boy himself was frail and underdeveloped . . . if there were not enough food to feed Mariano and his sisters and his numberless cousins—why, bring in new looms and medicines and seed, train the father and the others! Train, invest, and trust in change!

What if the old ones cried out in fear and damned the priest and those who would help him? What if families now squabbled and split? Mariano's life would be better—*all* would soon be better!

First the new sun-powered looms, obtained with the grant from the Union of Priests, and the instructor with his teaching-machines and his face that knew no patience. The looms would be the

breakthrough here, the first experience in a new way of life and the source of funds to support it. Pichicaihua's hundreds of weavers would quickly grow fat on their sales, and the others they trained in their turn to work in their fast-growing shops would soon buy new looms of their own. Food would flow in from the city, then seed and cattle from the market, then the luxuries all of us *need;* Pichicaihua would prosper as never before.

And so it was—for two years and a month.

In the words of a network journalist, it was "the miracle of Pichicaihua": sales agents flew in from the city, and observers from the Bishopric, and reporters by the score. The new looms were humming away, churning out the inferior goods the *turistas* favored with their pesos—and with those pesos, nearly half of Pichicaihua's eight thousand people were buying all they needed and more. Above all, they bought *pride.*

In the mushrooming hope and affluence, we mounted one new program after another: medexams and literacy classes and training in self-rule. And week after week, here in the rectory and out on the plaza and in the pews of the crumbling chapel, Mariano and a few score others came together to learn.

This was progress. This was *change.*

Then, abruptly, the plants in the city lowered their prices again, and the looms of Pichicaihua slowly fell silent, one after another, unable to compete. Attendance shriveled at our classes, then our other projects withered away. Thousands crept back to the overworked fields that year and the next, forced to sell what their all-too-quickly-won wealth had bought—their 'cubes and their groundcars and their elegant hats, and along with all that, their pride.

They sold it all, piece by piece, sold it in order to eat.

Of course, there were those who would not sell. One by one, and then more than a thousand, they left for the city—left to work yet bigger and faster looms because now their eyes were opened to the deceptive promise of speed. For months or years on end they stayed there, hunched over the keyboards of high-speed looms whenever they could find work, walking the streets of the ghettos when they couldn't. Fed the work-drugs by their supervisers or drugged by the filth and clamor of the city, they all lost weight and hope and will. Rufino was among them for a time, and his young son Mariano too—and back they came, the promise grown stale in their eyes.

The boy was eleven when they returned, these . . . thirteen years ago. With a scarlet bowler crammed over his eyes, he clambered down from the hoverplane and skulked off through the with-

ered corn in the shadow of his father, silent for all my solicitous greetings.

When three days later I saw Mariano again at last, he was flailing at the intractable earth with a long-handled hoe.

"What is this that happens?" I asked. "Does the sheep now bleat because the city has stained its wool?"

Softly, he said, with eyes averted, "Father Rufino says it is best that I tend to the corn and alfalfa."

"And what of the boy who would race the fly through the jaws of the mountain?"

"It is proper that a son do the bidding of his father."

Worried then, "What did you see, Mariano? What is the city that it ties your hands to the hoe once again?"

"There are demons in the city, *hermanito*." And after a pause, "Demons that come and howl in the night. Father Rufino says that here the demons live only in the mountain. Here they do not dare to pass."

And so he kicked and chopped at the soil, pissing away the months of his childhood, always averting his eyes. Captive to his father's will, he would not speak, he tried not to listen, while the father himself would do neither.

I had betrayed them cruelly, for I had proven as powerless as they to fulfill the hopes I raised.

But if Rufino was now lost to me, if he turned sullen when I approached and avoided me whenever he could, there was still the son to hope for: Mariano was not yet out of my reach, and for all his constitutional limits and the barriers raised by a hostile world, Mariano could still *dream.*

Constantly, with desperate patience, with all the guile and fire of the Revolution, I hounded him by day and night, in the fields, at his home, and on the plaza, and slowly—very slowly—the gleam crept back to his eyes and the questions to his lips:

"The people that gather in the city, *hermanito*—from where else do they come but Pichicaihua?

"Is it true that the poor like us are many?

"Will the soil of this place not support grand buildings like those of the city?"

Oh yes, he saw it too: the burned-out soil—*that* was the stumbling-block to change!

What if the new looms had made one disaster of another? What if hundreds still languished in the ghettos and thousands more were slaves to their hunger at home? What if the old ones now *shrieked* their scorn and flailed their arms in protest? What if my Bishop wanted another in my place? No matter! There was still hope for Pichicaihua, still hope for Mariano. The Revolution here had barely begun.

Bring on the agrarian engineers,

with their tools and their tapes and their tanks full of briny chemicals! Ask no questions of the fearful, spray by day where possible, by the light of the Moon where not—but spray, and exhort, and hold to the faith that human hands could yet undo the five centuries of tragedy they'd wreaked. The harvests could be abundant as never before—giant corn and leafy alfalfa and mountains of thick-skinned beans—and all would soon eat as well as they wished, and the howls and the doubts would be swallowed in the silence of well-being.

"Will the soil of this place not support grand buildings, *hermanito?*"

"Buildings first grow in the spirit, Mariano. And the soil bows to the will."

And so it was for those who took the new seeds and heeded the words from the headsets. The boy ate his fill like all in Rufino's family, and thousands of others in the village; one by one, the others limped back from the city, far poorer than when they'd gone, to find, at home, their own timid dream of revolution.

Once again, Pichicaihua prospered, yet this was no "miracle," there were no reporters, there would be no bubble to burst. Grim-faced, they all worked the fields and fattened the stock, distrustful of their new fortune, fearful now of the fast-talking priest who would have them envision yet more. They hoarded seed and animal feed, they kept their children at home, and they looked to the ground when I sought their eyes, for if my dream should explode again, it would not be I who would starve.

Yet in Mariano there was one (and all too few like him) whose eyes roved farther than the clouds in the sky, and no manner of distrust or stubbornness could keep him from my side. Though Rufino fought my every suggestion with whispers and grumbles at home every night, he freed the boy from the hoe for as long as prosperity should last, and our education—I say *ours*, Mariano's and mine as well—began in earnest that year.

We roved here and there, he and I—through the fields and over the mountains and into the stuff of legend and dreams. The months went by and Mariano grew in spirit, finding questions in every answer.

Finally, late one evening in the rectory, the walls of the village in his head totally split asunder.

"Tell me, Brother Julio—why do the stars blink so with fright?" He was fourteen, his voice changing fast, and the question was punctuated with a squeak.

"The fright is all within us, Mariano. The stars are only suns."

"Suns, *hermanito?*"

"Furnaces of light and heat so far we have not yet approached them."

"If the stars are all suns, what

kind of lands do they warm?"

He frowned gravely as he spoke, and I could only frown in turn, and point to the program tapes by the terminal.

"I shall walk those lands," he murmured, riffling through the tapes. "I shall eat the stars!"

And so he would, in great greedy bites, with the headset clamped over his ears, making furrows in his brassy black hair and furrows in his brow. While his father fumed and swore and spread tales of betrayal through the village, Mariano ground his way through geometry and algebra, trigonometry and physics, always with impatience. He holed up in the rectory for days on end, consuming astronomy and selenology and the speculative studies of the Interstellar League—and with the eidetic memory of the peasant boy he retained far more than he understood, confusing fact with theory and history with hope.

"I shall walk those lands, Brother Julio. Even if there be demons!"

But the demons of Pichicaihua swooped down from the mountain the following year, and with all too little warning the land died a second death, more tired and poor than ever through overuse of fertilizers. First on half-a-dozen parcels in one valley, then on hundreds spread throughout—everywhere, the crops came up stunted.

In Pichicaihua, the Revolution was at an end. There would be no more time for young Mariano to steal away from his father's fields and ask his questions and dream of the stars.

Midway through one afternoon when the boy was just fifteen, Rufino burst into the rectory—intoxicated, enraged—and ripped the headset away.

"The boy comes with me!" he screamed. "No more will you poison him with your lies!"

Not even I, city-grown and strong, was a match for Rufino in his fury—but Mariano was the boy he was.

"No lies have crossed the air of this room!" he shouted at his father. "Only the cries of a foolish old man!"

Rufino struck him across the mouth with the back of a weatherworn hand, shrieking, *"No lies?* Does this devil-priest tell you his Bishop called him away for the evil he did us with his looms? Called him away because he is crazy? No, he does not tell you he stays in Pichicaihua only to please *himself,* to spread his lies among us!"

I motioned to Mariano to make his escape, but in the grip of the moment—the terror, or the doubt—he stood, immobile, brushing the blood from his chin.

"Lies! Always lies!" Rufino persevered, shaking a fist by my nose. "Tell the boy about the cough in his chest, devil-priest! Tell him *that* is why I allow this foolishness with your crazy machines—because he must rest from the fields and the

looms. Tell him that the devil is not his father, but *you!* Tell him about the cough in his chest—the cough that will kill him if he takes one step on your lands-in-the-sky! Have you told him this, devil-priest? *Have you?*"

Mariano's head jerked up, his eyes went wide, and in that endless instant of disappointment as he read the truth in my face, he went as limp as the corn on an overripe stalk.

They left then, then or soon after—the father stumbling-drunk, the son bowed over, silent—each defeated in his way. But the boy was too young for such defeat, and the following morning he was gone altogether—gone from Pichicaihua, to seek his own way to the stars.

Of course, the ships he dreamed of in those days could never take him on with the brittleness of his lungs. Yet he has left just as surely, and forever—to launch his surrogate soul and watch it on its way.

For nine years now—nine *years*, my Sister—there has been no word from Mariano. No word for the father who held him back or the Brother who betrayed his own dream.

And here I am—an old, old man, awaiting another, mumbling into the 'cube.

Would that I could pray, in this Year of Our Lord Two Hundred Sixty-Two.

Rufino's eyes struggle to ignore the 'cube as the door whispers open between us. His hand is strong and cold.

"*Buenos días, hermanito.*"

"*Muy buenos, Taita* Rufino. Come, come inside—the air of the plaza has the teeth of a jackal."

Taking hat in hand, he steps hesitantly through the curtain of warmth, then moves to a spot between the 'cube and the lounger, finally sitting upon invitation with a servile deference that mocks me.

He accepts with a nod the mug of koffee I pluck for him from the warmer, then turns to scowl at the murmuring 'cube, where fifteen thousand technicians are assembled in the world's largest room. The newswoman is saying that the departure of the *Nôva Vida* has been firmly rescheduled for one hour twenty-one minutes from now.

"Mariano is definitely in that room," I say. "My Bishop has confirmed the report. Your son, Mariano Bagua."

Rufino hunches forward, squinting distrustfully into the 'cube. The network has cut abruptly to an exterior shot of the *Nôva Vida*, its sunward side so brilliant now that it devours the rectory's shadows—and, just as abruptly, the brilliance is muted as the ship becomes a transparent cylindrical model of itself, dangling in the blackness of the 'cube. Pastel compartments arrayed in beehive fashion about the skin of the model depict the colonists' quarters—living-space for

three-and-one-half *million*—and a rush of glowing sparks behind them represents the ion stream. Rufino broods, his old man's face spotted as though with fever by the kaleidoscopic effect of the model.

"I come to speak about the land, *hermanito.* You have given word that the new priest wishes to buy?"

"Yes, it is so."

"She wishes to buy my parcel which was my mother's mother's parcel? The one between the cherry grove and the eucalyptus in the valley of the Galombó? To build a school of plastic and metal?"

"Yes."

He faces the 'cube, impassive. "Never in all the years that the Pichicaihuas have sweated over the soil of these valleys has a parcel of land been sold to one who does not wear the ponchos."

It is an exaggeration, but I must let it pass. I nod.

"The old people will be very angry, *hermanito.* And many *turistas* will come in their flying machines, and frighten the sheep and the cattle. And the young ones will follow them about the village and beg for shiny coins. They do this, the young ones."

Rufino's face glistens in the light of the 'cube. Slowly, he raises the mug to his lips and, slowly, takes a sip. The model of Mariano's ship has shrunk to a flyspeck, arcing toward a simulation of the distant glow of Capella. For fifty years, an announcer explains, the *Nôva Vida* will accelerate on its way, and for fifty years it will slow its pace, and briefly slow to an aimless drift as its destination slowly draws near.

Rufino sits in the lounger, awkward and tense, warming his hands on the serving mug, peering suspiciously at the play of colors in the 'cube. Is it of Mariano that he is thinking—of my betrayal and the boy's? There is a hardness in his face that implies this . . . yet there is something *else* there as well.

The newswoman is interviewing the agency's director by interlink with his operational offices on Ceres, within eye's sight of the *Nôva Vida.* She marvels that he is free to speak, and so calmly at that, less than one and one-half hours from launch. There are many others at work, he says, the *Nôva Vida* is the work of many millions; it is what all the Earth's people have wanted and worked for—Brazilians, Chinese, wherever they are. It is in the hands of millions now, and no one person can be truly in charge.

"This woman priest . . ." Rufino says to the 'cube, sipping koffee.

"Sister Eugenia?"

"*La hermana, sí.* She will not be like you?"

"She will have her own ways," I say, puzzled, "yet still she is a priest of the Church."

"Yes." He nods, eyes averted.

"She is a *doctora,* Rufino. A teacher. The children will learn much from her."

Scowling at the 'cube, he hides his purpose in silence.

Yes, my Sister Eugenia, soon you too will sit with this man and puzzle over his ways. One day all too soon, your hoverplane will dart through the pass and whisper to a sudden halt above the sands of the plaza. Torrents of air from the tubular craft will send up clouds of sparkling dust, and out you will leap, my eager young Sister Eugenia, fresh-faced and trim in your formfitting blacks, with the priestly cross between your breasts. The children will come running and press in shyly with fear-filled eyes as the plane disgorges the crates of tools, the medicines and teaching machines, the replacement parts for the rectory's reference terminal.

You will grin, my brash young priest, so reminiscent of another, and fuss a bit until the equipment is safely stored, and in the hour we'll have alone together before the speeches and the dancing begin, you'll ask me for advice.

No—not advice, for Sister Eugenia is too intelligent and too self-assured for that. You'll lean back in the lounger, and finger the steel of your cross, and with a self-important frown and perhaps a glance through the window, you will say, "Tell me, Brother Julio—what has *changed* in Pichicaihua in these sixteen years you've been here? What has the Church *accomplished?*"

Those will be your words, or others very much like them—your own well-meaning young woman's way to deal with the dismal confusion all about you.

How will I answer?

Can I tell you the truth? That out of sixteen years of earnest labors, *this* is the Revolution? This one young man among millions in the 'cube—and he and a half-dozen others much like him—who need no longer grub in the earth or stagger, drugged, through the filth of the ghettos? One young man, forever estranged from father and home? One young man who can still *dream?*

Rufino is stirring, and the questioning mark that hangs in the air like an echo makes it clear he has been speaking.

"I beg you forgive me, Rufino. I am become the aging stallion that stamps its young hooves in the mind."

Gravely, Rufino thrusts a calloused brown hand at the glittering starship inside the 'cube.

"Why do they go, *hermanito?* Why must they go to the stars?"

How will I answer?

"They believe," I say slowly, "they believe that only among the stars can men and women live a proper life—a life that is truly of their own making. They say that we are dying on this Earth, that soon we will all perish."

"Yes, *hermanito.* I understand."

And he does—that much he does understand. His fingers trace a rag-

ged circle about the rim of the mug.

"And you, *hermanito?* Will you, too, go to the stars?"

"No," I say without hesitation. "I am too old, *Taita* Rufino."

I say this, though it is not age alone, or fatigue, that binds me to this Earth—and, though unsaid, perhaps Rufino understands this too. For all that my dreams were never his, he understands what it is to build a world in his own image and watch it crumble to dust.

"And you, Rufino? You will sell the land?"

"Perhaps," he says softly. "If it is the will of God."

Together we brood, two old men with little between us now.

The gleaming cylinder of the *Nôva Vida,* rotating slowly in the Cerean sky, burns after-images into my eyes. Inside the wombs of hundreds of women living aboard that ship that Mariano built is the flesh and blood of a new generation which may yet be warmed by the fires of Capella. And I will not join them, nor Rufino—but Mariano will, in his way.

The Revolution lives on, on a diet of stars.

And still you will ask me, *hermanita,* "What has *changed* in Pichicaihua?"

But I will say nothing about that.

No, I will tell her, "They will change *you,* Sister Eugenia."

And for years she will not understand. ■

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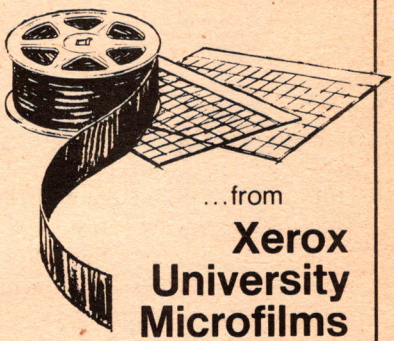

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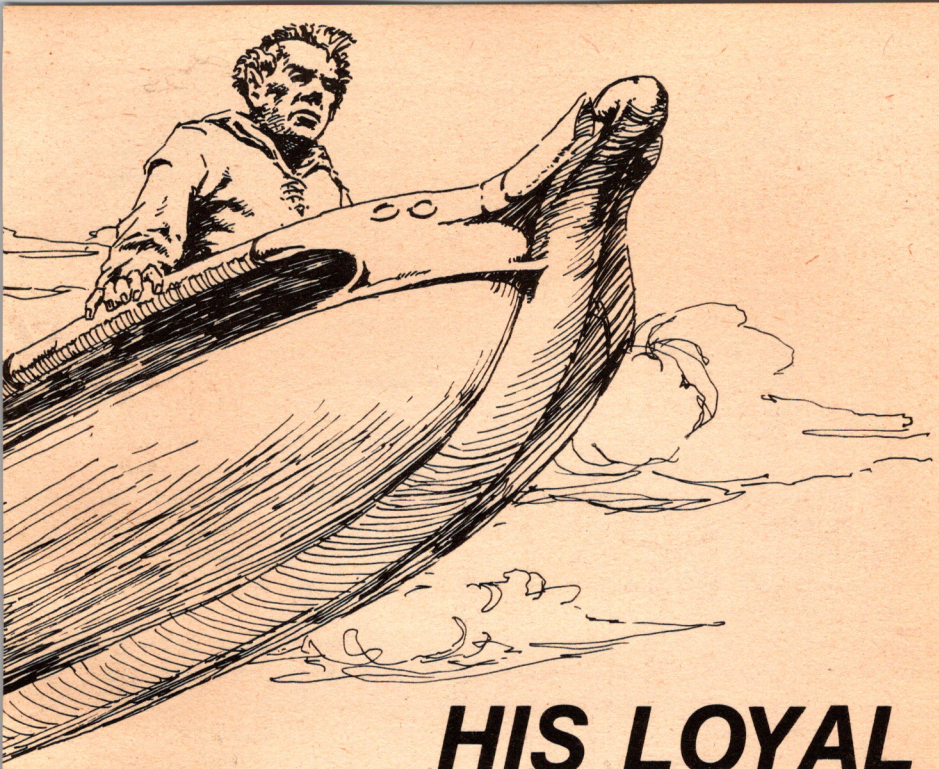
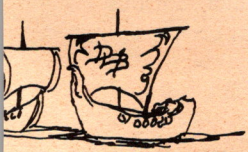


HIS LOYAL OPPOSITION

The difference between "orthodox" and "unorthodox" ideas depends on who's in power.

STANLEY SCHMIDT



DOUGLAS BEEKMAN

Ed. Note: This story is a sequel to "Lost Newton" which appeared in our September 1970 issue.

I

For a long, tense moment as the magicians from the stars rose into the clear sky, Terek and the dixar Kangyr stood silent, watching, stunned and immobilized by the outworlders' claim of magic that could kill at a distance. Even the two Temple lancers the dixar had ordered to stop them stood as if frozen in the midst of a threatening lunge. All their eyes followed the air-floater skyward, a thing of wood like a canoe, but flying, with an impossible figurehead and three alien occupants. It had dwindled to a black dot against the blue, following a long arc toward the thicket west of town, before any of them recovered enough composure to speak. Then Kangyr's voice was a rough, tight bark. "After them!" he snapped to the lancers. "See where they go. Don't let them get away."

Both lancers unfroze at once, swinging their forked weapons into position and completing their interrupted strides in a single swift motion. "Yes, Your Holiness," one of them muttered. Then they were off, eyes held skyward, running across the terrace to the stairs that would take them down and out of the monastery. They dropped out of sight and clattered out of earshot. Terek and Kangyr remained, looking after them, following the black dot across the sky. It was starting down now.

Terek stole a sideways glance at Kangyr—small in his purple robe, shriveled and pale in the unaccustomed daylight, but his face set in a tight-lipped, implacable scowl—and thought he knew what the dixar was thinking. His Holiness had intended—had actually attempted—to hold the outworlders against their will and force them to give him their magic. Magic which might save Yngmor from the perennial depredations of Ketaxil raiders.

And from the need to listen to the heresies of a young Disciple named Terek.

But now, if his lancers failed to stop the magicians, that chance would be lost forever. All that remained would be the two floaters, like the one in which the magicians had fled, which lay on the cobblestones at Kangyr's feet.

And Terek.

Terek wished he knew his own feelings as well as he thought he knew Kangyr's. But he hadn't sorted them out yet. Until a few minutes ago he had hated the magicians; it had been he himself that planted suspicion in Kangyr's mind. It had been quite obvious that they were determined, for whatever reason, to thwart the Temple's acceptance of his work.

That was no longer obvious. After their parting words, Terek

didn't know what to think. *"We have a lot more magic that you haven't seen,"* the one called Chet had told Kangyr, *"and some of it could help you. But the kinds that can help you most are the same ones Terek can show you. Let him."*

It was almost as if they had been as interested in his success as he was, and something had gone awry. He wished he could talk to them, ask them to explain. But there would be no chance for that, now—not unless the Templemen stopped them. And part of Terek didn't want that to happen.

If it didn't, he at least had their endorsement. Kangyr had sought their help because of their magic, and they had told him to listen to Terek. He would have to listen now. For they had told him Terek was right, and they knew because they were from the stars. Kangyr had to believe that. It explained their five-fingered hands—and much more.

The floater disappeared behind the treetops. The dixar Kangyr sat down on a low wall to wait; Terek remained standing beside him, not talking.

The lancers returned an hour later, tired, short-winded, and empty-handed. They performed the elaborate salute to the dixar and he returned it impatiently. He eyed them piercingly, his lips pressed tightly together. "Well? What did you find?"

The Templeman who answered avoided his eyes. "I'm sorry, Your Holiness. They're gone."

Kangyr's eyebrows rose slightly. "Gone? Where?"

"Vanished, Your Holiness. We saw them go down in the thicket and that was the last we saw of them. We found a clearing where something might have been. The ground cover seemed to have been pressed down by something large and heavy. But there was nothing there anymore."

"They may be hiding in the thicket—"

"No, Your Holiness. We searched the area. There's no way they could have hidden. They've gone . . . somewhere else."

Home, Terek thought, awed, *to the stars.* And even as he wondered at that, and at how they had done it, he felt a sort of relief. They were gone, which was best for all concerned. Yldac—and Yngmor, and the Temple—would have to make it on their own.

As the same realization reached Kangyr, he drooped. His whole being seemed suddenly crushed by weariness. He looked down at the two floaters the magicians had left and there was doubt in his eyes. "Then," he muttered bitterly, "we'll do without them. I will return to my chamber now."

The two with lances moved to his sides to help him. Terek watched them go, and then started alone for his study-chamber—which was now all the home he had left.

The dixar Kangyr walked slowly. He was old and tired—more tired now, perhaps, than ever before—and there were long flights of stairs ahead of him. Even with the two young Templemen flanking him, supporting him, it would be an arduous climb. There was no point in hurrying.

They're gone, he thought over and over, trying to realize it. *Gone. The outlander magicians—and all I'd hoped to get from them. I have nothing left but two of their floaters. And Terek. And problems.*

They walked along a narrow balcony with a low rail, from which he could look out over the cobblestone courtyard. It was full of grim reminders of his problems. The barbarian Ketaxil had struck again just two days ago, and it had been the worst strike in the history of Yldac. The looters had actually made it to the monastery. Now Templemen and Disciples roamed the courtyard, stooping to pick up trash blowing erratically over the pavement. Doors had been blackened by fire; chapels had been stripped of their relics. Quite clearly, he was going to have to try new things, and he was going to have to make hard decisions about exactly *what* new things.

But, he thought as they stepped into the soothing darkness of a musty corridor, *there's no hurry, really. Better to decide right than to decide right now.*

They should have at least the winter to prepare, he reflected. This raid had left Yldac too devastated to be of any further value to the Ketaxil until it had had time to recover. Quite probably they would not be back until the end of summer, when Yldac had new crops. And it was only autumn now.

But it was none too early to begin preparing—to see that the recovery was much more complete than the Ketaxil could anticipate.

They started up the long series of torchlit staircases. Kangyr paused often to catch his wind; each time his escorts held him and waited patiently. He tried to concentrate on the burning issue of what he should do, and his mind stubbornly persisted in idle speculation—useless speculation—about the outlanders.

Were they really from the stars? he wondered. *From a world that revolves around a star, just as Terek says Ymrek revolves around the Day Star?* His mind balked at that. It was too violently at odds with everything he and the Temple knew. And yet . . .

They had said Terek was right. And they could do things that no one else Kangyr had ever seen could do. Things that they said Terek could show him better than anyone else.

And now that they were gone, where else could he turn?

At last they reached the top of the last stairway. The guard at the door saluted him; he barely had

strength to return it. His two lancers helped him into his windowless chamber and up into his throne, and then left him.

As his strength slowly seeped back into him, he stared with a vague, irrational sense of annoyance at the icon of his younger self flickering in the torchlight above the door. It sometimes seemed to him that it—and the others like it on the walls—were staring at him, mocking him for what he had become.

Well, let them, he thought fiercely. *I have enough problems. I've done the best I could.*

And now, he imagined one of the icons challenging him, *what are you going to do about this?*

There were the floaters, he thought. He would have to have men trained to use the floaters.

But they wouldn't be enough. He remembered vividly—too vividly—Terek storming in here during the height of battle, furious with the news that his parents had been killed and his house burned, loudly insisting that the floaters were at best a partial solution.

Kangyr, in the privacy of his own mind, had found no way to avoid agreeing with him. So it seemed that he would have to call on Terek—most reluctantly—for additional help.

But there was a problem in that which he could hardly admit he faced, much less solve easily.

He brooded on it for the rest of the day, and then he slept on it. And in the morning he made a decision he would never have thought possible.

He called Terek in to tell him exactly what the dilemma was and ask his opinion.

Terek was surprised and vaguely embarrassed to see Kangyr's guard so low. He had seen the dixar in weak moments before, but never so weak as now. The three fin-like ridges that remained of his mane looked brittle; his big yellow eyes seemed to be hiding back under their craggy brow ridges. Occasionally they settled in a vacant stare on one of the wall icons; more often they were cast down at the tabletop between him and Terek, as if to avoid meeting Terek's. The tabletop was so highly polished that Terek could clearly see the dixar's inverted image in it, and even there their eyes seldom met. Terek listened uneasily to what Kangyr had to say. Finally, lifting his eyes so they did meet Terek's, he said tonelessly, "So you see my situation. I've decided you were right that we need more help than the floaters can give. I seem compelled to come to you for it—as the magicians themselves suggested. But in exactly what capacity should I use you? To put it bluntly, how can I accept even the practical parts of your work without losing face—and without seeming to condone heretical ideas?"

His eyes dropped again and he fell silent.

Terek stared at him for several seconds, silently pondering, feeling oddly sympathetic. He no longer viewed the dixar as the Temple did, but in certain important ways his attitudes toward His Holiness had mellowed since that change. Finally he said softly, "A dixar can *never* lose face, Your Holiness. By definition." It seemed almost unreal to have to remind Kangyr of that.

But Kangyr looked up at him, frowning, eyes questioning, mouth silent.

"You are the Supreme Presence, Your Holiness," said Terek. He no longer believed that, of course, but that was a private matter. It was still the best thing to tell Kangyr. "The Supreme Presence cannot be wrong. See? I can't even say it without twisting and maiming the language. If you can't be wrong, and everybody knows it, there's nothing more to say. Who could dare to question a dixar? No one."

Kangyr looked at him, scowling cryptically, for a long time. Then he looked away. "I can't believe that anymore," he said almost inaudibly. "They all tell me I'm infallible; they've told me for so long I'd started to believe it. But I can't now. I'm all too aware that I *can* make mistakes. And I don't have much time to waste doing it."

"But—" Terek started to interrupt, stunned to hear the dixar talking like this.

Kangyr waved him to silence. "I'm old, Terek. Someday, not far off, I must Pass the Power. But when that happens I want to leave a safe Yldac and a healthy Temple. A big order—and I no longer feel smug enough to tell the world I'm doing all the right things and there's no doubt about it."

"But as the local embodiment of the Presence . . . if *you* doubt, openly—"

Kangyr nodded, scowling wryly. "Yes, quite right. If *I* doubt, I have to bear it alone—as I've borne everything else. Can't let it show. You're right, Terek; I'll do it your way. I'll decide what I'm going to do and I'll do it boldly, as His Holiness who can do no wrong. But I wanted you to know." His eyes snapped suddenly, warningly. "You're not to repeat any of this to anyone, of course. Ever."

"I understand, Your Holiness." Which was true—up to a point. But Terek didn't really grasp why the dixar should be confiding all this to him. It was strangely exciting—and not entirely surprising—to learn that the dixar himself had suffered some of the same loss of faith Terek had experienced in recent days. But odd that he should be telling it to anyone at all.

And why Terek?

Abruptly, he almost felt that he saw some of the implications. But then the dixar was speaking again, his voice recharged with crisp authority. "I have my plan, and right

or wrong, it's the unquestionable will of the Supreme Presence. Here's what I've decided, Terek. Two things. First, we're going to use the so-called outworlders' flying boats. A corps of Templemen will be trained to fly them, and to pool ideas of how best to use them. And second, you'll have your chance. You'll have facilities and help, and my challenge to come up with whatever improvements in defense you can—and practical demonstrations that they work." He glared pointedly at Terek. "Please understand, you'll have these things, not with any promise that the results will be accepted or approved. In the vernacular, Terek, you're simply being given the opportunity to put up or shut up."

"I understand, Your Holiness," Terek said solemnly, while his heart pounded with excitement.

He left the interview tentatively gratified. Now his work would have a chance—perhaps such a chance that it could never again be threatened. For he had finally realized, as Kangyr set forth his two-point plan, what must lie behind that unprecedented confession—and this entire strange meeting.

Terek had originally been brought to the monastery, years earlier, as a Fledgling. It had been awhile since the possibility of succeeding Kangyr had seemed real, but now, thanks to the outworlders' endorsement (and their disappearance), it did again. True, he no longer believed all that the Temple taught—but, as it now turned out, neither did Kangyr.

And as dixar, Terek reflected as he hurried down the stairs to his quarters, he would have the power to *ensure* that his work would flourish.

For the dixar is the Supreme Presence.

The seed of hope lived on and grew, slowly but surely, during the ensuing weeks, as fall moved toward winter and Kangyr's programs became realities.

The air-floater program Terek viewed at first with mixed feelings, but there was more hostility than enthusiasm among them. The memory was still too fresh of how the Temple had once before seemed on the verge of accepting his work—until the outworlders came with their "quasimaterials" that seemed to defy the rules he had developed. The memory was bitter. He wanted to stay as far as possible from anything that might cause anything like that to happen again. Certainly he wanted no more competition from quasimaterials—and it was quasimaterials that made the floaters fly.

But gradually his annoyance at having them around faded. Gradually he came to admit—however warily—that they had some value, even if quite limited. They could fly across the water channels that had separated the towns since the

Shakes, out of reach of prowling Ketaxil ships. They could scout Ketaxil movements and bring advance word of raids. They could carry messengers from one town to another to plan cooperative defense efforts. Pilots learned to control the floaters easily and, quite early, a few messengers actually flew to neighboring towns to discuss the possibilities. Naturally such possibilities were greeted with considerable interest, and plans began to take shape whereby the towns might act together—forewarned—the next time the Ketaxil came around.

Even Terek found that comforting. And it became more and more apparent that, while the floaters would be very good for that sort of thing, there was little else they could do. Especially with only two of them on Ymrek, and no realistic possibility of getting any more. When attacks came—and they would—they would not be stopped by the mere knowledge that they were coming. They would be stopped only by such knowledge *plus* superior force—ready, waiting, and reliable.

That was where Terek came in. Part of his growing tolerance for the floaters came from the realization that they could help. More of it came from the certainty that they could only help in certain ways—which did not overlap his own work.

But most of it came from the plain, exhilarating fact that his work was now thriving as he had never dared seriously imagine before. Once it had been mere scribblings in his notebooks, seeking the simplest description of patterns he'd thought he saw in the behavior of Wandering Stars and falling bodies. It had culminated in a very simple description indeed: the Wandering Stars *were* falling bodies, in orbit around the Day Star; Ymrek was one of them; and moving objects followed very simple rules.

None of which, of course, had been pleasing to the Temple.

But now, despite all that had happened, Kangyr had given him the means to explore and check his ideas, not just on paper, but in hard, tangible reality. He had the exclusive use of an extended tract of land along the shore east of town, and he had the services of artisans and laborers. A few weeks after he had started, his test range held a wide variety of fixed and portable guns, and their reports could be heard at any hour of the day. There were small, hand-held guns like those he had seen the Ketaxil using in their last attack on Yldac. But the ones of most interest to Terek were some of the bigger ones, sporting refinements made possible only by his analysis of the laws of motion. Last year's models had depended on somebody with a good eye to aim them; these required little more than care and minimal ability to read. Their

mounts had calibrated setting circles so they could be aimed precisely in a specified direction, time after time after time. There were slide rule ballistic calculators for deciding exactly what direction was appropriate, and parallax range-finders for pinpointing a target without wasting powder. On calm mornings, when the air was still and the water glassy, they worked almost excellently. On windy days they were less reliable—but Terek knew how to fix that. It was only a matter of time until he had good enough gadgets to measure wind velocities. And performance at all times could be improved by an idea he had for pre-packing the powder in carefully measured standards loads . . .

There was plenty to do. But even in the first weeks, his guns proved so far superior to the old ones that Kangyr had no choice but to accept them and begin planning for their use. The acceptance might be grudging—the concept of nature obeying rules did not sit well with a Temple whose First Precept was "Magnificent and infinitely varied are the ways of the Supreme Presence"—but it was acceptance nonetheless.

And with it came renewed hope that Terek would be the recipient when Kangyr Passed the Power. Terek was not really anxious for that to happen, despite his frequent disagreements with Kangyr. But it must inevitably happen. And, in view of the dixar's failing health, it could come soon.

If it did, Terek could see definite advantages in succeeding to the Power himself. And more and more, these days, he seemed to be emerging from among the Fledglings as the only serious contender.

But that was before Khámngòng came.

II

They didn't even hear him at first. It was a day that heralded winter more surely than any yet this year, and the winds that whipped vagrant snowflakes around under the gray sky tended to mask other sounds. And Terek was busy.

He was with Arex, a very young but very helpful assistant, at the edge of his testing range. They huddled together on the ground by the landward wall of the tiny shack where he kept records, going over the morning's results and the afternoon's plans. The shack gave them some shelter, but enough wind got by to sting through their clothes. Terek hugged his dora-hide coat tightly around him and held the papers down with his hands on two corners and the wind-gauge they'd been testing on a third. "Not bad," he said, nodding approvingly at figures from the morning. "The best we've done yet. But still room for improvement—and we've come so far I don't know whether to try to make it in the gauge or the calculators or the guns." He frowned.

"Part of the trouble is that it's not steady. Well, nobody said battle days can't be gusty. If anything can go wrong, it will. OK . . . so how do we fix gusts? I think a higher muzzle velocity should help. Have them try this, Arex." He scribbled a prescription for increased powder charges and handed it to the youth.

Arex looked at it with intelligent interest and smiled. "Will do," he said. "I'm guessing it's a good idea, Terek. I hope it works."

He picked up the wind-gauge and walked off, slowly, keeping his coat tight and studying the paper Terek had given him. He was a bright boy and Terek liked him—enough so that, in a sense, he hated to see him spending so much time on this project. Commanding artillery was hardly the aspect of Terek's work he himself would most like to be concentrating on—but survival had to come first.

He rose, picking up the remaining papers, and started into the shack to file them.

And as he rounded the corner, he heard the cry on the wind off the water.

He stopped, frowning, not sure he'd really heard it. Looking out on the choppy, churning water, with the wind hurling oceanic scents in his face, he saw nothing. That was hardly surprising. Who would be out there now?

He started to open the door and go inside—but a strange uneasiness made him pause and look out on the water again. And this time he heard it unmistakably—a weak, hoarse cry for help—and he saw the long black shape rising and falling among the waves.

A dugout canoe, he realized at once, of simple design and crude execution. At first it looked empty, but then he saw the hand draped over the side, stirring feebly, its fingers barely reaching the water. The call for help came again, muffled and barely intelligible above the wind and the lapping of waves against the shore.

He would have to try to help. But there was something so odd in the situation that he was wary even then. "Arex!" he called. Then, hastily, he thrust the papers into the shack and shut the door.

Arex hadn't gone far; he was back almost at once. Terek pointed out on the water. "Somebody in trouble out there," he muttered. "I don't know who, but nobody in Yldac made that boat. We'll have to help, but I don't know what to expect. Go get some lancers back here, will you?"

Arex was off at a brisk run. Terek called a couple of small-arms specialists and walked warily to the edge of the water. He stood near the top of the stone retaining wall, watching the dugout being buffeted by the waves, tossed sometimes toward shore, sometimes away—but on the average coming slowly closer. He saw the hand and bare forearm better than before. It

looked strong, despite its present limpness. Not somebody who'd been adrift long enough to starve.

The two assistants joined him—not Disciples, but soldiers, carrying the shoulder-guns they'd been working on. The guns sprang from a Ketaxil example, but where theirs had been crude things that fired several balls at once, Terek's group had refined them to use a single slug. Now they were safer, but the accuracy still had a long way to go. Terek felt frustrated every time he looked at them.

One of the gunners looked at him, puzzled. "Who's out there? Do you want us to—"

"I want you to stand by," Terek interrupted curtly. "Don't do a thing unless I tell you. Arex has gone for some Templemen."

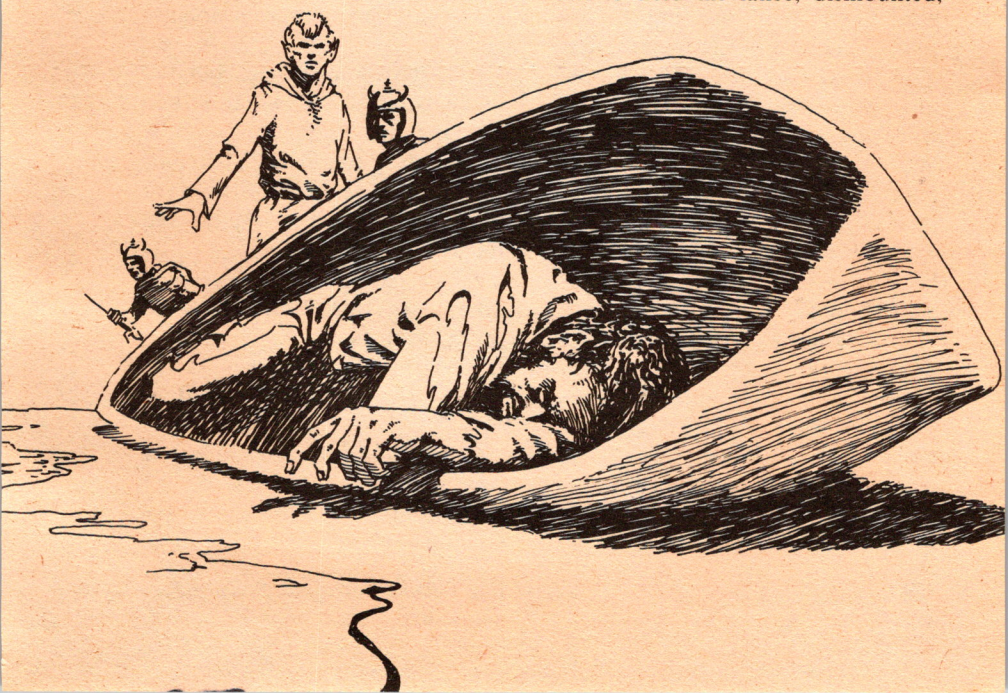
The boat drifted closer. Terek almost gasped aloud when he saw the big form stretched full-length in the bottom—but neither of the gunners showed any sign of recognition.

Hoofbeats heralded Arex's return, running behind two Templemen mounted on big, shiny-antlered doral and carrying forked side lances. They halted at Terek's side and looked down at him.

"What's up?" one of them asked.

"Don't know," said Terek. "Somebody out there. It'll be in close enough to grab soon."

One of the lancers motioned Terek to hold his lance, dismounted,



and took the lance back. He stepped to the water's edge. When a wave tossed the canoe close enough, he thrust out his lance and managed to hook a gunwale with one of the barbs. Slowly, almost capsizing it once or twice despite his care, he dragged it in. "Get ready to help," he grated to everyone else on foot.

He hauled it alongside and somehow they wrestled it onshore. Terek saw quite clearly now that the man stretched face down in the bottom of the boat was indeed as tall and dark-maned as he had thought. He was lying very still, but caution was definitely in order.

"I can't believe this," breathed the Templeman who had dismounted. "Watch him, Lemrol." He crouched next to the still-dripping black hull and braced his lance against it while Lemrol circled warily on his dora, lance points down and ready. The crouching lancer reached into the boat and rolled the limp figure over. His eyes were closed and most of his face was covered by a wild full beard of the same color as his dark mane—much too dark for a Kengmor's.

And no Kengmor would keep his or her beard.

One of Terek's small-gunners jerked his weapon up to firing position, his eyes suddenly wide with fear. "A Ketaxil!" he gasped.

Lemrol, high on his dora, brought his lance down sharply, knocking the gun down. "Don't," he said. "He's no threat now." He looked at the other lancer, worried. "Xynglik, we'd better think about this."

Xynglik nodded grimly. "But let's think fast. My first thought's to kill him, too. No Ketaxil's harmless." He stared at the weakly breathing figure. The thin, tattered clothes that hung on it—wet and totally unsuited to the wintry weather—were a far cry from the leather-and-metal armor they had all seen on Ketaxil in battle. But there could be no doubt of the identification. The racial signs were unmistakable.

"I don't like it," Xynglik said finally. "What can we possibly gain by keeping him alive? I say kill him now—and then keep a sharp eye out for anybody who follows him."

Terek started to protest, but before he could speak, Lemrol rode closer and put his lance tip at the bedraggled barbarian's throat. "Maybe you're right," he said thoughtfully. "It'll be simplest and safest—"

The Ketaxil opened his eyes and spoke. "Asylum," he croaked, weakly but distinctly. "Asylum!"

Lemrol withdrew his lance slightly, but abruptly, startled. "What?"

"Asylum," the Ketaxil repeated. "Take me to Kangyr. The dixar." He spoke Lingmor haltingly, with a heavy Litaxil accent.

Lemrol looked uncertainly at Xynglik. "This is very strange," he said. "What do you think?"

"The Disciple Terek has seen more than we have," Xynglik observed. "What does he think?"

Terek asked a question that he would have thought obvious. "Is he armed?"

Xynglik frisked the Ketaxil and stood up with a shrug. "No." He frowned. "That's very odd."

"Then he's not dangerous," said Terek. "So—"

"But if it's a trap—"

"Then, more than ever, we need to keep him alive and find out what kind of a trap. I say let him live. Give him enough food and water and warmth so he can think and talk. And then do exactly what he says: take him to the dixar Kangyr. In the meantime . . ." He eyed the figure in the boat suspiciously and with conscious tight reins on hatred as he remembered all his previous experiences with Ketaxil. ". . . watch him like a hawk!"

Lemrol looked at him skeptically for several seconds. "Very well," he said finally. "On your say, Disciple."

By the following afternoon—after several bowls of gruel and a closely guarded night in a cell with fresh sleeping straw—the stranger was deemed ready for an audience. Lemrol and Xynglik were out of the picture now, back to their regular duties. But when two monastery guards led the captured Ketaxil at lance-point to the dixar's lofty chamber, Terek was there too.

The warrior—looking much healthier today, but still wild and disheveled—faced Kangyr from the opposite end of the long table. The guards never left their posts behind him, weapons always at ready. Looking at him from one of the long sides of the table, it occurred to Terek that he looked oddly at ease for one in his position. Not really relaxed—but somehow he didn't seem to feel quite the *kind* of agitation Terek thought he should.

It was unnerving, in a disquietingly quiet sort of way.

Kangyr stared at the prisoner—refugee?—for a long time, silently sizing him up. Finally he said, "You have a name?"

The prisoner nodded, shaking his heavy mane and beard. Their blackness showed a coppery sheen where the torchlight caught it. "Yes. Khámngòng." Each syllable was carefully level in pitch, the first high, the second low.

Kangyr accepted it without comment. "You are a Ketaxil warrior?"

"I was, Your Holiness."

Kangyr's eyebrows flicked up very slightly. Terek felt a definite twinge of surprise at hearing Khámngòng call the dixar "Your Holiness." Certainly no one had expected it. Kangyr hadn't even demanded the salute.

"You say you *were*," the dixar frowned. "You're not anymore?"

"No, Your Holiness."

Holiness, again. *Maybe just buttering him up,* Terek thought, *because he really needs asylum.*

Or because he wants us to think he does.

Kangyr was addressing him. "Terek, did you see any sign of other Ketaxil—or Ketaxil watercraft—when you heard Khámngòng calling for help?"

"No, Your Holiness."

Kangyr looked back at Khámngòng. His lips curled slightly with what could have been sardonic amusement. "I was going to ask you next why you'd come here. It seems I should ask first why you've left the Ketaxil."

Khámngòng nodded slightly. "Yes, Your Holiness." His eyes were piercing black, his expression brooding, his voice surprisingly soft. His Lingmor remained halting and heavily accented, but he spoke it carefully. "I left them," he said, "because I could no longer live with them. Unfortunately I didn't realize that soon enough to leave gracefully."

He paused. Kangyr waited, lips pressed sternly together.

"I have a . . . talent," Khámngòng said slowly. "It is difficult to explain . . ."

"Try," Kangyr said flatly.

"I share thoughts . . . sometimes. Sometimes my own, sometimes others'. Sometimes it is hard to tell." He shut his eyes. "Sometimes it would happen during a raid. You know the Ketaxil love for cruelty in battle. Try to imagine taking part in that, plundering and smashing. And then imagine that suddenly, against your will, you think what your victims are thinking and feel what they are feeling as vividly as if it were happening to yourself." He opened his eyes. "That happened to me, Your Holiness. Several times. I could stand no more of it. I resolved finally to participate in no more violence myself—and to try to convert my people to a different way of life."

Kangyr couldn't hide his skepticism. Not at the notion of sharing thoughts, of course; there was nothing in that to make a Templeman bat an eye. But Ketaxil renouncing violence? Kangyr just said, "And . . . ?"

"They would not be converted." Khámngòng's voice quickened with remembered anger; more mistakes crept into his language. "They wouldn't listen at all. They resented me. They mistrusted me because I could not always use my ability to help them plan their raids. Sometimes I could, but all that mattered to them was that sometimes I couldn't. They hated me more when I refused to keep killing, and still more when I tried to get them to follow my example. Finally a group of them attacked me. They beat me and took my armor and set me adrift in the canoe with

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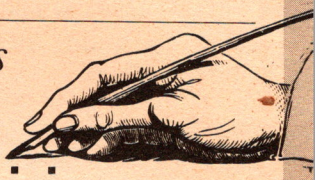

BEST NOVEL:
THE FOREVER WAR, Joe Haldeman (St. Martin's Press, Ballantine)
(Analog published several Haldeman stories, among them "Hero" and "End Game," which were included in *The Forever War.*)

BEST NOVELLA:
"HOME IS THE HANGMAN," Roger Zelazny (Analog)

BEST NOVELETTE:
"SAN DIEGO LIGHTFOOT SUE," Tom Reamy (Magazine of Fantasy and Science Fiction)

BEST SHORT STORY:
"CATCH THAT ZEPPELIN," Fritz Leiber
(Magazine of Fantasy and Science Fiction)

BEST DRAMATIC WORK:
Awarded to Mel Brooks for "YOUNG FRANKENSTEIN"

A SPECIAL SFWA AWARD was given to GEORGE PAL
for his long career of excellence
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The following works published in Analog in 1975 appeared on the final Nebula ballot:

NOVEL:
THE INDIAN GIVER, Alfred Bestor
DOORWAYS IN THE SAND, Roger Zelazny

NOVELLA:
"THE STORMS OF WINDHAVEN," Lisa Tuttle
and George R.R. Martin

SHORT STORY:
"DOING LENNON," Gregory Benford
"A SCRAPING OF THE BONES," Algys Budrys
"CHILD OF ALL AGES," P.J. Plauger

little more than when you found me." He paused. "I had a paddle, but I lost it."

Kangyr stared at him with a peculiar, hard-to-read expression. Skepticism? Yes, but there was more than that in it—something that Terek found vaguely disturbing. Finally Kangyr said, "And you just happened to wash ashore at Yldac?"

Khámngòng lowered his eyes. "Not entirely, Your Holiness. Partly, yes. My first problem was simply to survive, to land anywhere I might live safe from my former fellows. But in the time before hunger and exposure made it hard to think, I realized that if I evaded them and landed anywhere among these channels, I would fall into the hands of Kengmorl. I could expect little sympathy from them. My only hope was to come directly and forthrightly to a town and throw myself on the mercy of its dixar. Yldac was close, and I thought I remembered my way through the channels to it."

"And here you are." Kangyr nodded slightly, tiredly, letting his eyes roam to one of the wall icons. "An unusual story. You'll forgive me if I don't seem entirely convinced. But one must be cautious." His eyes snapped back to Khámngòng. "And now that you're here," he demanded, "what do you intend to do?"

"I am at your mercy," said Khámngòng. "All I ask is to live. If there are ways I can earn my keep . . ." His voice trailed off.

Kangyr nodded again. This time it was not only a reply to Khámngòng, but a signal to the guards who had stood ready through the whole conversation. "We shall see," Kangyr said curtly. "Take him back to his quarters and see that he's fed." One of the guards nudged him with a lance and Kangyr added sharply, "There's no need for that."

They went out. Terek remained behind, watching the dixar as he sat slumped in his chair, gazing abstractedly at the wall. He looked *too* thoughtful. Terek said, "Your Holiness?"

"Yes?" Kangyr did not look at him.

"What are you going to do? It seems to me there's considerable danger in letting a Ketaxil live among us. And yet you hardly even touched on that."

"You heard his story," said Kangyr. "His case is highly unusual."

"But is his story true? Couldn't it just be a way to play on our sympathy to get a foothold inside the monastery? What could be more convenient for the Ketaxil than to have a spy living right here with your trust?" He thought of a still more alarming possibility and added with rising urgency. "And just suppose his story *is* true—"

Kangyr cut him off with an impatient wave of his hand, still with-

out looking at him. "I have already supposed that. Terek, what are you afraid of? All he asks is shelter. He'll be guarded. Have you no charity?"

"But—"

Kangyr jerked his head around suddenly to glare devastatingly at him. "But what?"

Terek looked at him silently, coolly, for several seconds. He was still convinced that the danger was extreme—and, abruptly, that it had facets he hadn't even imagined before. But he was getting nowhere trying to convince Kangyr. Finally he dropped his gaze, with an appropriate display of humility, and murmured, "Nothing, Your Holiness."

He didn't press the point until several weeks later, when he heard from his old tutor, Ravilyr, that Khámngòng was being taken into the Temple as a Disciple. The conversation—like most of their conversations these days—was brief, with an undercurrent of strain. And Khámngòng's presence in the monastery had been kept quiet and unobtrusive from the start. So Terek didn't really know, in any detail, what the situation was. But he found Ravi's news so shocking, so incredible, that he went at once to the dixar's chamber.

He climbed the stairs so fast that he arrived short of breath. The guard let him in right away and he stood there with little energy for anything except the salute until several seconds had passed. Kangyr's response was little more than a limp, half-hearted flap of his hand, reflecting his general deterioration—which seemed to grow visibly faster with each passing week. Terek felt sorry for him. But senility—if that was what it was—could not excuse dangerous irresponsibility. Not even in a dixar.

Finally Terek found the strength and self-control to ask, "Your Holiness, is it true that you intend to make Khámngòng a Disciple?"

Kangyr, slumped in his throne, his eyes watery and barely half-open, showed no physical reaction. He just said, his voice hoarse and weak, "It's true that he *is* a Disciple."

"What?"

"The ceremony was an hour ago. Here. A small one. If I . . . seem tired, that's the reason."

Terek hardly knew what to say. He stammered a little, he thought—later he couldn't remember for sure—before he managed, "Your Holiness, do you think that was wise?"

Kangyr emitted a short, faint sound that might once have been a derisive laugh. "Still questioning the unquestionable, eh?" He sounded too tired to care. "Yes, Terek, I think it was wise. I *know* it was wise—which is the same thing. Have you talked much with Khámngòng since he came to us?"

"No, Your Holiness." Terek had

wanted as little to do with him as possible.

"I have," said Kangyr. "I've been . . . favorably impressed. Very favorably, Terek. He came to the Temple under unusual circumstances, and his response has been equally unusual. He was once our enemy—but he's converted most completely. He tells me it started with gratitude to us for granting him asylum—but when he saw the peace and devotion in the minds of Templemen and Disciples, he decided he must give himself to the Temple. I could never turn away dedication like that, Terek. Khámngòng has become not only a Disciple, but one of the most devout and promising of Disciples. He doesn't have all our doctrine yet, but he has a natural affinity for it and he's learning fast. You don't need to worry about him." For a fleeting moment, his eyes brightened and he cast a pointed glance at his wayward Disciple.

And Terek knew, with a sudden chill, why it was even more urgent than he'd thought that he worry about Khámngòng. He knew now what hidden facets of the danger had troubled his subconscious even that first day—and why he must fight Khámngòng's infiltration into Kangyr's good graces in any way he could. "Your Holiness," he said tightly, "do you still see no danger in the possibility that Khámngòng is a spy?"

"I see no such possibility," Kangyr said very quietly. "What are you afraid of, Terek?"

"I'm afraid," Terek exploded, "that this barbarian is going to trick Your Holiness into letting him learn so much about us that the raiders will be able to completely destroy us the next time they come. Hasn't it occurred to you that if he really is a telepath he could send all kinds of information back to his tribe? Without even setting foot outside our monastery?"

"It has occurred to me. It's also occurred to me that the same things which could make him a dangerous spy could also make him a valuable ally. I consider that far more likely. You don't appreciate the completeness of his conversion as I do."

"But if you're wrong—"

"A dixar is never *wrong!"* A year ago he would have thundered it; now he tried, but the effect was lost. "Haven't you learned that yet?" He glared sternly. "And I hope you learn soon that Khámngòng is not a barbarian. He's a Disciple of the Temple—like yourself."

Those words stung, but with an effort Terek pretended to ignore them. "But still he may have deceived us. If he is a spy, he'd want to give exactly the impression he's given you. If he's a competent spy, he'd succeed—"

"Terek," Kangyr interrupted, aiming his eyes at one of the icons and shutting them, "I'm getting

very tired of this. If you're going to continue it, please do it where I can't hear you."

Terek stopped, stunned. "What?"

"Leave. You're not saying anything new or valuable, and I'm tired."

Terek stared at him for a few more seconds, started to say something else, then turned and started to leave. He was shaking with the realization that Kangyr was now viewing Khámngòng with very special favor—and Terek with renewed annoyance. And his health was sinking fast . . .

"Terek," the dixar said behind him.

Terek stopped but didn't turn. "Yes, Your Holiness?"

"Are you sure you're not afraid of more than you've told me?"

He's not all *senile,* Terek thought bitterly as he heard how well the dixar read him. *Of course I am. Who could blame me, after what I went through with the outworlders? And besides* . . . "Maybe I am, Your Holiness," he said quietly. "That's for you to decide. But even if I am, that doesn't change my point."

As the winter progressed, it became increasingly evident that the end was near, for Kangyr—and that Terek's fears about Khámngòng were well-grounded. The worst of them was never explicitly acknowledged, but from what *wasn't* said, Terek felt a growing certainty that

it had become a real threat. Finally, with some misgivings, he decided that the time had come for a long, earnest conversation with Ravilyr—their first since a day he wanted to forget in Kangyr's chamber.

He walked slowly through the corridors, dark between shafts of sunlight slanting through icicle-fringed windows, to Ravi's door. He hesitated before he knocked, and then waited tensely. He heard footsteps approach slowly from the other side. Then a latch clicked and the wooden door swung outward. Ravi, his robe gathered snugly around him, looked startled. Terek had not sought him out in his chamber for some time.

"Hello, Terek," the older Templeman said softly. "What can I—"

"Hello, Ravi." Terek smiled at him; it took a little effort, but not nearly as much as it might have a month ago. "I need to talk. Do you have some time?"

"Certainly. Come in, come in!" Terek followed him into the small room, dark except for a few candles and a meager fire in the fireplace. Ravi's pale orange mane—with the crests beginning to show through, lately—seemed softly luminous in the erratic light. He sat down on the one simple stool and motioned Terek to the straw-covered sleeping platform. They sat facing each other for a few seconds and then Ravi arranged to smile and say, "Well?"

Terek sighed. "I have to know about Khámngòng. A hunch I've had lately. Is he . . ." He looked straight at Ravi and blurted out, "Does Kangyr consider him a Fledgling?"

Ravi looked slightly away, seemingly sorry that Terek had asked him that. But he nodded.

Terek wasn't surprised. Disappointed and, in a sense, hurt—but he had thought about it enough already to numb him to any acute pain at the news. It merely removed the element of uncertainty from what he had already guessed. Now it would have to be dealt with as a known quantity rather than a disturbing possibility. He asked, "A serious competitor?"

Ravi nodded again. "Your *only* serious competitor," he said. "But quite a serious one, I think."

That was no surprise either, really, Terek asked tightly, "What can I do to stop him?"

For a moment Ravi looked at him, strangely. A barely palpable tension flared and flickered between them. Then he said, very quietly, "I'm not entirely sure it's best that you do stop him, Terek."

That *was* a surprise—a crushing one. Terek said weakly, "What?"

"I'm not sure it's best that you stop Khámngòng. I don't mean I'm sure it's best that he stop you; I mean I don't know. I don't know what's best. I'm trying very hard to decide what I think."

"But . . ." Terek fumbled for

words. "I know Kangyr put you on a nasty spot that day in his chamber. But before that I'm sure you recognized the value of my work. And—"

"I didn't fully grasp how it fit in with Temple doctrine, then," said Ravi. "Or failed to fit in. 'Magnificent and infinitely varied are the ways of the Supreme Presence.' How can you believe that and also believe that nature follows rules—and such simple rules that a mere Disciple can state them, at that?"

"Well, it does. You've seen what my rules let me do. They're going to give us a chance against the Ketaxil. And more—"

"Yes, and that's what scares me. Not the prospect of surviving and maybe even ending the invasions; that's great. But the idea that it'll look like it's all due to your laws—I'm afraid you and your laws have been too successful. They may make us forget the First Precept."

"Well, maybe we've been looking at it wrong, anyway," Terek said. "The rules have proven themselves. And the First Precept has led to things like Templemen being taken in by Khámngòng *saying* he can do tricks—but never showing us."

Ravi looked at him sharply. "That's strong language, Terek."

"Well, *has* he shown us? We don't know what he is, Ravi. Maybe he's a Ketaxil spy and maybe he's a turncoat who can help us. Maybe he's a telepath and maybe he's a charlatan. I suspect the latter. Whatever he is, we may be stuck with him as dixar. Do you want that, Ravi? Think about it. Suppose he's everything he says he is. At best his alleged talent can help us occasionally—and unpredictably. Meanwhile, he's a fanatical convert who's swallowed old Temple doctrine hook, line, and sinker. He'll be more of a threat to me than Kangyr ever was. He's a traditionalist all the way—and with no background of experience to temper his judgment." Terek looked at Ravi earnestly. "He's already made some harsh statements about my rules. But those rules are the only thing that's bought us any real gains lately. Ravi, he'll crush them if he gets to be dixar!"

Ravi gave him a long, discontented look. "I'm not sure your work *can* be crushed anymore," he said slowly. "It has too much momentum. I think there's more danger of your becoming too powerful and crushing everything else." He stared into the fire, eyes glazed with doubt. "I don't know what the answer is, Terek. Maybe it would be good if you and Khámngòng could rule jointly—to keep each other on your toes without losing either your ideas or the Temple's." He shrugged. "But of course, that's out of the question."

"Of course." Such a thing was never done. Even if it had been possible, Terek would have found the thought of trying to co-govern with Khámngòng far from appeal-

ing. He shifted the topic back to real issues. "I still say we can't afford to let a traditionalist like Khámngòng have the Power. You won't help me try to prevent it?"

Ravi shrugged again and looked back into the fire. Xyratl made scurrying noises somewhere in the wall. "I'm sorry, Terek. We'll just have to wait and see."

III

Kangyr's expectation of at least the winter and probably more to prepare should have been quite reasonable, of course. So perhaps Lemrol should not be entirely blamed for the attack that came.

It was one of those days that burst upon winter-deadened senses like an unexpected reprieve from the execution pit. The calendar and the icicles that still hung on trees and houses said it was too early for spring—yet suddenly the air was warm and clear and breezy. A few brash plants even ventured to unfurl flamboyantly colorful buds, heedless of the frost that must surely return.

But until it did, Lemrol could sympathize fully with the exuberant shrubbery. He felt the same way himself. He was riding a dawn patrol, alone and unhurried, along the narrow packed dirt streets that wound between rows of tightly shuttered shacks. The air blew gently against his face; he heard nothing except the breeze and the soft klip-klopping of his dora's hooves. He came out into the open where the town met the water and turned right, following the shore east toward the rising Day Star. Its fiery pink light glinted off a dozen spots on his mount's antlers, and off the shaft of his lance, cradled in the fork between two tines. On the water itself it flashed in a million dancing wavelets, brilliant, blinding, exhilarating.

But blinding. So blinding that at first he didn't see the two black specks silhouetted against the red sky on the horizon just north of east. When that fact registered, he halted his dora abruptly. He sat there, heart hammering, as he sized up the situation.

Ketaxil ships—two of them. Far out, and apparently not moving—though the light was too bad to be sure. He wondered whether they'd planned that deliberately.

In any case, they were Ketaxil. Nothing else had that outline. The best thing that could be done about them would be to destroy them immediately. The Disciple Terek's big guns should have a good chance.

Nervously, he lifted his lance free of the dora's antler and shifted it to ready. He turned and started off to alert the gunners.

And then the motion caught his eye. Off to the northeast, much closer than the ships—two blue shapes, moving this way, barely visible against the water. But they quickly identified themselves as big Ketaxil landing boats, rowing

swiftly shoreward, their oars unheard over the breezes.

With sudden shock, Lemrol spurred his dora and bolted off to the east. First he would have to alert the gunnery crews; there was no time to consider anything else. The boats were already far too close, thanks to their color and the wind and the light. *Still*, his conscience nagged, *if I'd been watching earlier, as I would've been if we'd been expecting an attack . . .*

He left word at the firing range, hardly pausing long enough to get his dora turned around. Then off to the monastery to leave word there. Even as he sped away from the gunnery range, he heard the soldiers rousing and gathering their weapons.

When he got back to the shore, after a very brief exchange with a gatekeeper at the monastery, it had already started. The two landing boats hovered a few yards offshore, each still occupied by a handful of dark-bearded warriors. They all yelled; one maneuvered each boat erratically while the others used crossbows and blunderbusses to hold off Keldac troops on shore, trying to set the boats afire. Lemrol couldn't tell how many Ketaxil had already landed, but he knew there were more than he saw. From time to time he heard the sharp report of one of Terek's shoulder-arms from some nearby hiding place. Some of the raiders followed their old customs, parading boldly in the streets, laughing, going after hidden enemies with crossbows and guns and swords, loudly defying anyone to strike them down.

And, far too often, getting away with it.

Not always, though. Darting through the streets in a confusing search pattern, Lemrol found one down, bleeding from a ragged wound that must have been from a Keldac firearm. And around the next corner he found himself galloping down on one standing with his back this way, racing a pair of Keldac beyond to see who could reload first. He had too much momentum to think about stopping; a well-trained reflex lowered his lance as he approached. The Keldac gunners saw him and reacted unthinkingly, alerting their opponent. The Ketaxil whirled with a shout, just as Lemrol arrived. The lance caught him in the side and ripped free as Lemrol rode on past. The Ketaxil's gun discharged as it flew out of his hands.

Off to the east, one of Terek's big shore guns boomed.

In a well square, Lemrol found a small group of Keldac in close combat with a similar group of Ketaxil, all of them reduced to clubbing and slashing rather than shooting. Keldac were no match for the bigger, stronger, more experienced Ketaxil. They were taking a bad beating.

None of them saw him yet, Lemrol realized suddenly. With no fur-

ther thought, he dipped his lance and galloped into their midst. He downed one of the Ketaxil and created enough confusion for a couple of the Keldac to dash for shelter where they might reload. He felt a sword scrape hard against his leg armor, and bowled the scraper with the side of his lance.

Three of the raiders had broken free of the fray and were running at amazing speed up a cobblestone radial street toward the nearest grain warehouse. Lemrol grimly took off after them. They mustn't be allowed into the tyraxet reserves.

Two of them ducked aside to the right, the third to the left. One of them fired a blunderbuss. Lemrol's dora bellowed with pain and crumpled under him, sending him flying over the antlers to land sprawling and breathless on the cobblestones. He struggled frantically to get his lance back under control. They would be on him now, committing the atrocities they were famous for.

But they weren't. The tyraxet was what they had come for, and for once they seemed so set upon business that they passed up even this chance. Two of them, anyway, turned at once and resumed their mad dash for the warehouse.

The third Lemrol didn't understand. He dashed off just as madly, but in a different direction. He disappeared down a periphery street, barely giving Lemrol time to notice his unusual bright-red headband with two trailing ribbons. For an instant Lemrol thought of chasing him to see what he was up to, then abandoned the idea. He'd be hard to catch, and he wasn't as important as the two headed for the warehouse. He couldn't stay hidden long . . .

Meanwhile, there was much else to do. Alone, Lemrol knew he couldn't stop the other pair. But he'd better get some well-armed Keldac up to the warehouse right away—and they'd have to be very careful not to provoke any fires there.

Already at least three other fires were roaring nearby and townsfolk were screaming in the streets. Terek's shore gun sounded again, and shouts nearby told Lemrol that another landing boat had arrived and its crew was streaming ashore.

To Kangyr, high above the town in his windowless chamber, the battle sounded even more distant and unreal than the others he remembered. A lot of things seemed to be getting like that lately.

But this, he reminded himself with an attempt at sternness, *was* a battle. A raid. Down there on the periphery, people of his town were getting killed and Ketaxil warriors were raiding what little Yldac had of value.

And one of them—the Disciple Khámngòng—was standing at the other end of this table, frantically trying to tell him something about it. He tried hard to concentrate.

"Yes, you're right," Khámngòng was saying. He seemed to be exasperated about something. "They shouldn't have been back this early. But they are, because they miscalculated. You've got to understand, Your Holiness—"

Kangyr nodded slowly, staring dreamily at Khámngòng's image in the tabletop. "Yes," he murmured. "They miscalculated. Tell me again about that, Khámngòng."

"Yes, Your Holiness." Khámngòng seemed unduly agitated. Kangyr wished he could see better, to judge his expression. "The Ketaxil have always lived by raiding towns—originally on the coast, later along the waterways opened up by the Shakes. They try to strike when there will be good things to take, to take enough to get them comfortably through the winter, and to leave enough so there will be enough the next time. This year they misjudged. They squandered so much of their booty during the winter that they already need to go out raiding again. But carefully. They have a master plan—"

Kangyr frowned, vaguely puzzled. "How do you know this, Khámngòng?"

Khámngòng sighed. "As I told you before, Your Holiness. I shared their thoughts."

"Hmmm. Then why didn't you tell me sooner? We might have prevented all this. If they hadn't caught us by surprise—"

"I didn't know, Your Holiness, until the raid was underway. But the other towns don't have to be surprised. That's what I'm trying to tell you. Now that we know their overall plan—"

"Yes. Yes." Kangyr cradled his chin in his hand and gazed at the icon over the door. It no longer focused. There was something vaguely troubling in all this, but he couldn't pin it down. So he let it pass. "Tell me about this plan."

"They've realized they have a shortage, Your Holiness. They see that they have to make it up, but they know they don't dare hit any town too hard now or there'll be nothing at the end of summer. So they've worked out just how much they dare take from each town. They're making systematic rounds, taking just so much and no more at each stop. I know where they're going next—"

The reality of the guns outside registered enough to make Kangyr ask bitterly, "How does that help us now?"

"It doesn't help Yldac, Your Holiness. Not directly, this time. I'm sorry about that. But it's a perfect time to use the outworlders' air-floaters."

"I'm still not sure they're really outworlders," Kangyr muttered. "But possibly you're right about the floaters." He rubbed his chin thoughtfully. "You mean we use the floaters to send word to the next town . . ."

Khámngòng nodded vigorously.

"Yes! Send someone to warn them before the Ketaxil arrive, so they can make preparations. And then the floater can go on, and warn all the other towns. It can carry messages among them to work out a plan for concerted defense. The Ketaxil can be thwarted as they've never been thwarted before. They'll *have* to start finding other ways to live."

"The idea has merit," Kangyr said slowly, turning it over in his mind. He wished he could think faster. It seemed to him that he used to . . . "I'd only send one floater, of course. We've never had them out under battle conditions before. Better hold one in reserve." He fixed his eyes suddenly on Khámngòng. "When do you suggest we send the messenger?"

"He should get ready right away," Khámngòng said, somehow seeming relieved. "It might be safest to wait until the raiders are off Yldac. But not much longer, if at all. It's not far to Yjhavet, and they plan to travel fast and strike fast. And they don't plan to stay here long."

Kangyr nodded. He pondered silently for some time. Something in him hesitated to commit himself—and even one floater. But this was what he'd got them for, and Khámngòng certainly seemed right that, if ever there'd been a time to use them, this was it.

He made his decision. "We'll do it," he said grimly, even though something still troubled his subconscious. "Find Templeman Xymrok, Khámngòng. Send him to me right away."

Kangyr wasn't there when the floater took off, and Xymrok felt distinctly nervous as he climbed into the stern of the canoe-like contraption. He had ridden it a couple of times before, once even to Yjhavet. But this time there were still scattered yells and gunshots up toward the shore, and that was where they were headed. Xymrok had timidly suggested that perhaps it would be best to wait until the last trace of battle was over and the Ketaxil were out of sight. But His Holiness wouldn't listen. The message, he insisted, had to go now. Time was of the utmost.

The young Templeman who was to be his pilot climbed into the bow and sat down with his back to Xymrok. Silent, businesslike, he took the two wooden levers in his hands—the ones that controlled the magic-sticks in the bow and stern. He moved them slightly and the floater lifted silently off the balcony, rising to clear the railing and floating out over the edge.

Xymrok gasped involuntarily and clasped the gunwales tightly as the town came into view below. They were accelerating fast and he still had occasional twinges of acrophobia. But today he had to look, to see the extent of the damage. It wasn't as bad as last time, but it

was bad enough. A couple of shacks still burned—he could smell their smoke even up here—and a few bodies lay in the streets of the northern periphery. Temple soldiers scurried like xyratl around the row of guns off to his right, along the watery edge of Terek's field. The occasional shots he still heard seemed to come from there. Apparently the fighting in the streets was about over, but Xymrok still felt edgy. Those landing boats, darting like big blue piscoids toward the two ships he could barely make out on the horizon, weren't really terribly far below. He hoped this youngster at the helm was climbing fast enough . . .

Terek stood on the retaining wall between two of his guns, watching the boats go and forcing his mind to keep working. The worst seemed to be over, but this was no time to relax, even if he was exhausted. But it was getting harder to think.

The last boats were going, and his guns were ready. The salvos they had already fired still rang in his mind, if not his ears. But was it worth firing more now? The ships, cleverly hiding just over the horizon, were no targets at all. The boats, even weighted down with captured grain and meat, were so maneuverable they would be hard to hit. Even if they *were* hit, the food was still lost. The time to hit them would have been when they were coming in, not going out. Too bad their new camouflage and approach—and timing—had kept them from being spotted soon enough.

Yet, any who could be stopped now would weaken the Ketaxil's future raiding forces. Would they weaken it as much as the spent ammunition would weaken Yldac? Still he hesitated. A part of his mind urgently warned him that the choice must be made soon or there would be no choice at all. *Hurry,* it said. *Hurry* . . .

"Sir," said a voice at his side. "Sir, look there." One of the small-gunners was pointing at the sky with the muzzle of his weapon. Another boat was there, well above the ground, climbing fast as it passed out over the water—the outworlders' air-floater, carrying two Templemen. Terek felt a sudden surge of gratitude for its presence as he watched it soar skyward. He had resented them, once—but then he hadn't spent several hours trying to defend Yldac with his guns. Now he had, and he appreciated all the help he could get. Silently, fervently, he wished the floater a good swift journey.

And then he caught the sudden flash of motion out on the water. He whirled to see sunlight glinting on metal as two Ketaxil in one of the boats wrestled with something he hadn't seen before. A gun, apparently, portable, but too big for one man to handle.

They were swinging it onto the floater.

Too late, he realized what they were doing. "*Stop them!*" he yelled, nudging the soldier and pointing out on the water. The soldier frowned; he didn't seem to understand. Part of Terek tried to explain while his eyes cast wildly about for an alternative. There was an extra shoulder-gun on the ground near his feet. He scooped it up, hoping it was loaded and knowing he was not practiced in its use, swung it into position, and fired.

He missed—and even before he got the release back, he heard the blast of the Ketaxil gun. His eyes swung reflexively to the air-floater, just in time to see it snap in two in midair with a loud, sickening noise. The splintered middle pitched wildly up, hurling the two occupants out. They fell, flailing and shrieking, to the water; it seemed to take forever, and they hit with huge splashes. Above them, the two halves of the floater hung uncertainly for a fraction of a second. Then one of them plummeted headlong to the water, and the other followed in a long, lazy, crazy spin.

Terek must have stood motionless, full of a sick feeling, for several seconds before he acted. Then any thought of trying to pick off a few more Ketaxil was forgotten.

"Over there," he rasped to his gun crew, motioning toward where the floater's pieces and crew had fallen. His voice sounded oddly distant. "Have to save anything that's left . . ."

There was not much. The fact tormented him late that afternoon, when he and Khámngòng stood together—not too close—at the end of the table in Kangyr's chamber. Often, when Terek had been here lately, he'd found himself loudly—perhaps arrogantly—trying to make the dixar see the error of his ways. Today he was strangely quiet. He was too conscious of his own failures.

Kangyr stared at them—first one, then the other—for a long time before he spoke. He had withered away appallingly during the winter. His skin was loose and deeply wrinkled and mottled; the ridges on his head drooped and had begun to crumble. And yet today there was a kind of fire in his eyes that Terek had not lately seen there. He was weak and given to remoteness, but now his mind was entirely present, and it was written on his face in patterns of terror and wrath.

Finally, with his hands clutching the arms of the throne and trembling, he muttered, "My two best Disciples! Look where we've got in a few short hours. Raided, months before we should have been. Shacks burned; food stolen. One of our floaters—the only two floaters we have—destroyed on its first real mission. Templeman Xymrok—"

Terek shuddered. "Was it defi-

nitely destroyed, Your Holiness? Men were searching—"

"Destroyed," Kangyr repeated with infinite bitterness. "They've abandoned the search. The bow half of the floater was fished out; of the other half, with its control stick, no trace. Evidently it sank. We'll never find it. The pilot was rescued. But Xymrok . . ." He shut his eyes and pressed his lips very tightly together. "Xymrok drowned. They pulled him out not long ago, already half eaten by things that live in the sea."

He sat silent for several seconds, then opened his eyes and leaned forward, glowering at Khámngòng. "Khámngòng!" he snapped suddenly. "Why did you let this happen? Why didn't you warn me before they got here?"

"I did not know before they got here, Your Holiness." Khámngòng spoke softly. He always spoke softly; it seemed incongruous, Terek thought. But his Lingmor had improved tremendously since his arrival last fall.

"And yet," Kangyr pursued, "you could tell me afterward—when it was too late—that it was part of an elaborate plan? You could tell me why they were doing it, and where they would strike next, so I'd know where to send the floater?" He shook a hand limply at Khámngòng. "If your talent could do all that, why couldn't it tell me what they were up to *before* the damage was done?" He stared piercingly, challenging the adopted Disciple to explain.

And still Khámngòng remained passive and solemn. "As I told you the day I came here, Your Holiness, my talent is a sometime thing. It works well at some times and not at all at others. I have little control over it."

Terek seethed. What rot! "Your Holiness," he said with careful restraint, "may I suggest another explanation?"

Kangyr shifted his gaze to Terek. "Yes?"

"I've tried to tell you this before, Your Holiness. Please listen to the whole thing before you judge. I say Khámngòng has no 'talent' at all—except a talent for getting people to believe he does things that he says he does. Things which, conveniently, nobody else can check."

"You know nothing—" Khámngòng protested.

"May I finish?" Terek said roughly. Khámngòng broke off. Terek looked back at Kangyr. "I say he has no talent for sharing thoughts. But he does have the full support of the Ketaxil pirates for whom he's still a spy and a saboteur. Think about it, Your Holiness. He didn't warn you of the attack—but while it was going on, he persuaded you to send one of our floaters up. Doesn't it seem that the whole thing's been an elaborate plot? He's played on your confidence to trick you into letting the floater be shot down."

"Your Holiness," Khámngòng muttered menacingly, turning slightly toward Terek, "must we listen to this? Baseless slander hardly becomes a Fledgling—"

"Enough!" Kangyr glared sternly at Terek. "A dixar is not gullible," he reminded. "Still . . ." He turned back to Khámngòng. "Perhaps we could all rest easier and get on with our business if you could share enough with us to remove any doubt of your sincerity."

"I've told you over and over," Khámngòng said with visible, carefully bridled annoyance, "I can't do it whenever I feel like it."

The three of them shared a cracklingly tense silence, staring at each other, starting to say things and reconsidering. "No matter," Kangyr said darkly at last. He didn't press the point, but the degree to which his faith in Khámngòng was shaken was plain to see. "What matters is that the floater was shot down, and we were counting on them. We only have one left, and nobody on all of Ymrek knows how to fix them. So I ask both of you: what do we do about that?"

Long, awkward silence. Khámngòng said slowly, "*Possibly*, Your Holiness, I could contact these outlanders who made the floaters, and persuade them to come back. I can't promise, you understand. But I can try."

Kangyr nodded slowly—not with enthusiasm, but with a desperate willingness to try virtually anything. "Please do," he said curtly. "Terek?"

Terek shook his head silently, unable to do more than fume with exasperation over Kangyr's showing Khámngòng even that much confidence.

He and Khámngòng left the chamber together, openly at each other's throats. "Charlatan!" Terek growled as they started down the long torchlit staircases.

Khámngòng glared at him with those odd black eyes. For once he showed active indignation. "Just because my talents don't follow your rules doesn't mean they aren't real," he said softly. " 'Magnificent and infinitely varied are the ways of the Supreme Presence'."

"That line," Terek hissed, "has been used to justify far too much rubbish. Like yours. If I were dixar, I'd start stamping out some of the abuses."

Khámngòng stared at him, aghast, in the fleeting window-light on a landing they passed. "You dare speak against the First Precept? The Opposed Powers—"

"Not against the First Precept," Terek snapped back. "Only the abuses. Only the rubbish. It's high time we all started getting it through our heads that real things do follow laws. And instead of using the Precept to justify every fable anybody concocts about things that don't, we need to recog-

nize those things for what they are. Fables. Superstitions. Frauds. Nonsense."

"But they aren't," Khámngòng insisted earnestly. "Not all of them. What I do, for instance—"

"What *do* you do?" Terek demanded.

Khámngòng stared at him. "What?"

"What do you do? How do you do it? What does it feel like?"

They had reached the bottom of the stairs and stepped out into the courtyard. Khámngòng stopped and frowned, troubled. "It's hard to describe," he said. "And I have little control—"

"Then how do *you* know it's real, even?"

"How do you know you see?" Terek felt a slight psychological jolt. He'd never thought of it that way. Khámngòng went on. "Suppose I blindfolded you but sometimes I took the blindfold off. You'd have no control over when you saw, and you wouldn't be able to predict when you'd be able to see. But would you have any doubt about when you could and when you couldn't?"

Terek found himself frowning, annoyed—and not entirely for reasons he liked to admit. Khámngòng's analogy didn't seem quite fair. And yet he couldn't pin down what was wrong with it. He started across the courtyard, toward a breezeway which would lead him out through the wall into the street for a calming evening walk.

Khámngòng followed. "Suppose there *are* things that act like that," he was saying. "Things that exist but don't follow simple rules. Don't you see that you might bury those along with the rubbish, if you started branding everything superstition that didn't seem predictable and regular? Maybe your rules work, Terek, but not for everything. And as dixar . . ."

Terek didn't want to listen. Maddeningly, he found himself thinking of the outworlder magicians. He wished he'd had more chance to talk to them. They'd said their quasimaterials were a distant outgrowth of Terek's laws—and he could believe that, now, because there did seem to be some sort of reproducibility in their behavior. But telepathy? The outworlders had never mentioned anything like that. Did that prove that such things didn't exist?

Or . . . was it perhaps possible that their Terek had been too successful, as Khámngòng said? That, by achieving too much with certain kinds of law, he'd crowded out others?

Terek didn't want to think about it. It reminded him too much of things Ravi had said not long ago. And that made him want to think about it even less.

He quickened his steps toward the gate. Khámngòng was still droning on behind him. Terek turned and tossed scornfully back

over his shoulder, "Frankly, Khámngòng, I haven't seen the slightest shred of evidence that you *ever* really do anything. And until I do . . ."

He didn't bother to finish the sentence. He stomped angrily out through the breezeway, past the guard, into the nearly empty marketplace of Wall Street. He heard Khámngòng call his name behind him; heard his steps quicken briefly, then halt, turn around, and recede.

He didn't look back.

"*Terek! Hide!*"

The warning was so urgent, so loud, so commanding, that Terek didn't think about it at all before he reacted. He'd been walking clockwise around the broad street. Now, reflexively, he dived to his left, into the pile of trash and scraggly shrubbery next to a market stall at the intersection with a radial. Even as he flattened himself against the ground, trembling, he heard the blast of a blunderbuss and the smack of a ball striking an empty crate two feet from his face and shattering it into splinters. He managed to steal a glance through the branches, back up Wall Street toward where he'd just come from. A Ketaxil warrior, marked by a conspicuous bright-red headband with two trailing ribbons, had apparently seen him just after he emerged into Wall Street, and had popped out of another radial and tried to shoot him in the back.

He'd almost succeeded, Terek realized with a shudder. If not for that warning . . .

The red-banded raider's blunderbuss still smoked in his hands. Already—deftly, swiftly—he was reloading. As he finished and thrust the ramrod back through his belt, he was running this way again, straight for Terek's hiding place. Terek wondered wildly where he could go, and saw no answers. He felt more certain than ever before that there was no way out.

Then he saw the other moving figure—another Ketaxil, but in the baggy olive-brown costume of a Temple Disciple. Khámngòng had appeared up behind the warrior. The warrior heard him and tried to turn, but not in time. Khámngòng was already leaping upon him, jerking his head back, sending him reeling backward. As he staggered, Khámngòng grabbed the blunderbuss with both hands. For a while—a few seconds?—both of them held it and struggled for it, both with the strength and skill of Ketaxil. Then, unexpectedly, Khámngòng's foot lashed out and his opponent lost his grip and went sprawling on his back. He flailed, trying to shield himself, yelling frantically in Lita-

xil, as Khámngòng lifted the blunderbuss and swung it like a club.

Then, abruptly, he was still.

"Guards!" Khámngòng yelled hoarsely toward the gate. Then he stared with an inscrutable expression at the unconscious form on the pavement and sank down beside it. He sat there, silent, obviously badly shaken.

He must have been sharing during that battle, too.

Slowly, now that there was time, awareness of what had happened flooded into Terek's resistant mind. But there could be no doubt. The warning had been real—there was no question about that—and it had been the only thing that saved his life.

And yet . . . thinking back, he realized, also beyond question, that he hadn't really heard anything at all. No sound was involved.

And there was no way either he or Khámngòng could have *seen* his attacker to trigger the warning.

Two Templemen with lances came trotting out of the monastery, going cautiously to the warrior

Khámngòng had captured. Everything was under control now.

Terek, his mind deeply troubled, walked slowly back toward the gate. "Well," he muttered grudgingly as he walked past Khámngòng, "I guess it did work this time . . ."

He still couldn't quite bring himself to thank Khámngòng.

But the incident haunted him for the next two days. And at the end of that time, late at night, came word that the dixar must see him right away.

And the messenger wore a hooded pink cape.

IV

The somber pink hoods were everywhere in the dixar's chamber, on the dozen or so Templemen gathered there. Terek had never seen them before—for they are worn on only one occasion, and that comes seldom.

A dixar never dies, of course—or so teaches the Temple. He Passes the Power. And the occasion when he does so—when the local embodiment of the Supreme Presence passes from an old body to a young one—is the most solemn ceremony in the Temple's entire repertoire.

To the casual eye, Terek thought with oddly flavored irony, as he squeezed into the already crowded room, *it must look a lot like dying. With ceremony.* He stared at Kangyr's small form stretched full-length on the tabletop, still in his purple robe. His eyes were closed, and he lay so still that Terek wondered at first whether he had already ceased to speak. Then he saw the dixar's throat move, barely perceptibly, with breathing. It was not over yet.

Relieved, but apprehensive and confused, Terek looked around at the still faces contemplating the dixar. He recognized most of the pink-hooded Templemen, but really knew few of them. Only Ravi, in fact . . . by the empty throne . . .

Next to Ravi towered Khámngòng, brooding, still in plain Disciple's garb—the only other person in the room not in the pink ceremonial dress. Silently, Ravi nodded to Terek, indicating that he should take his place. He walked slowly, gingerly, to his post on the opposite side of the throne from Khámngòng. He waited, alternately gazing with genuine sorrow at the old dixar and trading furtive, suspicious glances with Khámnòng. In the artificial hush, his anxiety grew insidiously.

Ravi spoke—very softly, but it echoed off the hard stone walls. "Everyone is here, Your Holiness."

Kangyr neither moved nor opened his eyes. But he spoke—lips barely moving, voice a mere whisper, words coming slowly. "The time has come," he said, "to Pass the Power. Soon . . . one of you . . . will be me."

Yes, Terek reminded himself. *Try to believe that . . . no matter how much you don't.* For despite all his disagreements with this dixar—this one who can never be wrong—he did not look forward to his death. Better the Temple doctrine that it was not death at all, so no sorrow was in order . . .

"You know the Fledglings," Kangyr was saying, amid long, frequent pauses. "Terek. And Khámngòng."

Yes, Terek thought, trying to grasp the reality as he had never done before. *In a few minutes, I may be dixar, with all that implies. I . . . or Khámngòng.*

"You know my reservations," Kangyr went on. "About Terek . . . you know. About Khámngòng . . . there have been doubts expressed. You know them. I need not repeat."

He paused for a long time. Terek thought of the doubts Kangyr meant—and his own. In a few minutes, Khámngòng might have the Power. Devout traditionalist Khámngòng, with his "talent" and his danger of crushing Terek's work in the bud. The prospect was chilling.

And all the more so now that Terek knew that Khámngòng's talent was real—and so different from the phenomena he had studied that he would have no idea how to develop or even encourage it. In the last two days, trying to be honest with himself, he had seen a frightening corollary of his fears of Khámngòng crushing his work with laws of motion—and all that they might lead to.

Khámngòng had something, too. And Terek might run just as grave a risk of crushing that.

No matter how hard he tried not to.

Ravi, he found himself fearing, had been right.

"You might think," Kangyr said as Terek's pulse and breathing gathered speed, "the choice is difficult. But I remind you . . . I am the dixar. For me . . . when I make the decision . . . there is only one decision possible. It is simply the way of things. Trust it."

Maybe, Terek thought suddenly, with the bitterness of futility, Ravi had been right about other things too. When he had said, while musing wildly, that Terek and Khámngòng should rule jointly—maybe that *would* be best.

If it were possible.

It wouldn't be easy, of course. Far from it. They would be constantly at odds, constantly wanting different things and fighting stubbornly to get them—and all the while struggling to preserve the necessary illusion of unanimity. But they would, as Ravi said, keep each other on their toes. And each would have enough power within the Temple to see that any potentials he had would have a chance.

But that, Terek reminded himself sharply, was idle dreaming, not

worth the waste of time. There was no way it could be.

Or . . . was there?

A sudden thought struck him and his heart began a crescendo. He wished Kangyr would hurry to the point.

The *right* point.

The dixar had been silent for a long time. He seemed to have lost his train of thought. Now he rolled his head slightly toward Khámngòng and said, "Khámngòng . . . have you contacted the magicians?"

Khámngòng didn't answer right away. "No, Your Holiness."

"Hmmm? Then perhaps . . ." he murmured dreamily ". . . perhaps Terek was right? Perhaps you are not really . . ."

He broke off. Momentarily, he squirmed, gasping for breath. When that subsided, he lay still, but his breathing had become fast and frantic, yet weak. He started to speak a couple of times and finally managed, "In any case . . . I Pass the Power . . . to Terek . . ."

The word ended on a questioning note. But it ended, and Kangyr's head rolled to the side, and he was perfectly still. Even the breathing had stopped.

For a moment everyone stared silently. Then Ravi nodded and gestured faintly toward a close cluster of pink-hooded Templemen. Silently and solemnly, but briskly, they stepped toward the body on the table. Handling it with surprising lack of gentleness, they stripped off the purple robe, leaving nothing beneath but pale, wrinkled skin and jutting bones and joints. They carried it briskly around the back of the throne to drape it over Terek's shoulders.

His heart thundered. It would be so easy—and in one way, so tempting—to leave it at this. But he had made his decision, and Kangyr had given him the opening. He must use it boldly. *I,* he told himself forcefully, *am the dixar now.*

Only seconds had passed since Kangyr's last words—fewer seconds than in some of his pauses. As they settled the robe on his shoulders and all in the room started to give him the dixar's salute, he drew himself up very erect and gazed grandly out over them. As he flashed his response back at them, he heard the deferential murmuring of, "His Holiness, the dixar Terek." He left no pause before he added in a clear, ringing voice, *"And Khámngòng!"*

Silence crashed over the gathering. Khámngòng looked at him, sharply, wondering. Templemen fought to conceal frowns; Ravi didn't bother. Terek knew what they were thinking—and he knew his reply. Even as his inner feelings churned at the thought of what he was doing, he radiated the absolute confidence of a dixar.

Finally Ravi ventured a stunned whisper. "But, Your Holiness. There can't be two dixarl in one town—"

Terek shot him a staggering stare of utter contempt and indignation, playing the part to the hilt. "*You would defy a dixar?*" he roared, as if the idea was unthinkable.

For, in Temple doctrine, it was.

"There are dixarl in all the towns at once," he pointed out, just a shade more gently. "Now there are two here—and I suggest you show proper deference to His Holiness Khámngòng. The dixar Kangyr duly designated me, but he didn't finish. I completed his utterance: he Passed the Power, through me, to both of us. And there is nothing more to say." He stared defiantly, daring them to say more.

But they didn't, of course. Only a few more seconds of shocked silence prevailed. Then, one by one at first and finally in unison, they gave Khámngòng the salute and he returned it.

And Terek had a dazed moment to reflect on the enormity of what he had started. He felt a tremendous uncertainty about where it would lead—but it included tremendous hopes as well as fears. As he thought about it he felt an upwelling of pride and anticipation.

Both he and Khámngòng would have their chance. Let it lead where it might!

For it was done and it was irrevocable and the responsibility was his—absolute, with the absoluteness that the Temple itself provided.

For the dixarl are the Supreme Presence. ■

THE ANALYTICAL LABORATORY

The AnLab is your chance to tell us which stories you like best, and thereby reward your favorite authors with solid cash. It works this way: send us a card or letter with a list of the stories in each month's issue, ranked in the order in which you preferred them. We average the votes and publish the results here. The story that comes closest to having an average of 1.00 (which would mean it received a first-place vote from everyone voting) earns its author an extra one cent a word: $100, in the case of a 10,000-word novelette. The story in second place receives a half-cent extra per word.

April 1976

Place	Title	Author	Points
1....	Children of Dune (Conclusion).....	*Frank Herbert*.....	1.588
2....	Rebounder.....	*Hayford Peirce*.....	2.606
3....	Transfigurement.....	*Bob Buckley*.....	2.848
4....	Quarry.....	*Mary H. Schaub*.....	2.939

DOLLS' DEMISE

Serendipity doesn't always mean a pleasant surprise discovery.

GEORGE GUTHRIDGE

Gentlemen of the press, friends, my dear, dear employees. I have asked you here for an announcement which brings me great sadness. You may have heard rumors about what is to happen. The world will know soon enough. But I wanted to tell you myself, in person.

At the end of the next month the Reznick Doll Company will close its doors forever, as will all doll companies throughout the country. The rubber-mold presses will be shut down; the sewing machines will cease to hum.

You, my dear employees, will be guaranteed comparable jobs in other industries. Yet you will have lost something precious. We were not a large company, but we were a closely knit one. We worked hard. I have come to look upon you as family.

The decision to close was not mine, of course. Nor was it a matter of economics. Sales are booming, and as you know we were about to introduce our revolutionary Rock-a-Betty doll.

Rather, the decision was the government's.

And the decision, I'm afraid, involves more than just the doll companies. Shortly after the companies close, dolls will be banned altogether. The exact beginning of the ban will be announced in the papers. No longer will little girls cradle their favorite dolls; no longer will doting grandmothers stay up all night sewing doll clothes for Christmas or birthday presents.

The reason for this drastic action is both complex and far-reaching in its ramifications. I'll try to summarize as simply as possible.

As you may know, during the last couple of years our industry has come under fire from various feminist groups. It was charged that dolls are a tool of a male-dominated society, that they are used to condition girls to accept motherhood.

Naturally, those of us in management were sensitive to the charge. But we did not merely turn our

backs to it. Perhaps we should have—though I doubt if that would have affected the outcome. Only postponed it.

The industry undertook an elaborate and expensive research program. We asked psychologists, sociologists, and, yes, even pediatricians to study the charge. They were given complete freedom. We even allowed representatives of the feminist groups to supervise the research. For we were sure we were right. We were positive that a child's desire for any given toy is a matter of that child's—and not society's—preferences.

The researchers' findings supported our opinions. It was concluded that female children really do prefer dolls over other toys. The feminists were satisfied with our findings, and we thought we were home free.

But unfortunately, the researchers also made a second, even more startling discovery. And some members of the Board of Population Control got hold of the information.

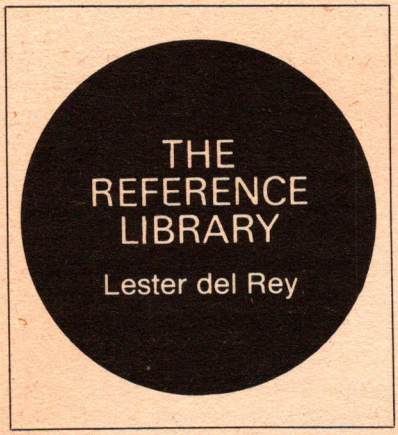
The researchers concluded that girls do not play with dolls as preparation for having children.

Rather, women have children in order to continue playing with dolls. ■

in times to come

It's been sixteen years since Robert Silverberg has graced the pages of Analog. One of the most popular science fiction writers of this generation, Silverberg has also written literally hundreds of works in other fields, both fiction and non-fiction. He claims that his newest novel, SHADRACH IN THE FURNACE, which highlights our August issue, is his last work of science fiction. Sad news, if he sticks to it. Because SHADRACH just might be his best novel . . . and certainly one of the best we've seen in, well, maybe sixteen years.

Joseph Goodavage's interview with Carl Sagan will also be in our August issue, together with lots of other goodies—including the first Probability Zero piece we've published since December 1944!



O TEMPORA! O SCRIPTORES!

Once upon a time, there was an editor—purely hypothetical—who discovered some strange books among those sent to his office for review. And he called in his reviewer and said: "Maybe we should have a column on these books." You see, in general he was—hypothetically, of course—a very decent sort of an editor who usually gave his reviewer a completely free hand. But he was also a somewhat sly editor. For he said to himself: "If those books get reviewed in the manner I'm sure they will be, my reviewer will get all the hate mail for that month, and I'll have some peace."

But the reviewer also had a touch of slyness, so he bowed low before his editor and agreed, saying to himself: "If I review those books honestly, I'll get hate mail. But so will my editor get hate mail for letting me write such a review. Man, will he get hate mail!"

Hence, there'll be no science fiction reviewed this month.

Actually, the two books that were sent to the office instead of to my home address were more interesting than a lot of the stuff that is sent to me. The regular science fiction publishers send me science fiction, of course, with an occasional straight science book or novelty item they think I might like. But others insist on sending me everything except the few sf novels they publish. I'm blessed with almost every book on flying saucers, astral projection, spiritualism, and general kookery that gets into print.

We like to think that science fiction is generally recognized today as a normal category of literature. Believe me, there is a large element of the book publishing world that doesn't have the faintest idea of what it is. To them, anything that seems irrational, wild, cultist, or simply silly is obviously science fiction.

Normally, of course, I don't bother with such books. Testimony gained by hypnotism means nothing to me; a hypnotic subject is too willing to supply any answers he discovers the hypnotist wants—and will often later be convinced he has told the truth. Flying saucers began to bore me after the first hundred books I had to read for a radio show years ago; besides, the more testimony there is for great numbers of the things, the less probable they became; one or two alien visits might be conceivable, but hundreds—at those fantastic requirements for time and energy—are ridiculous.

I don't have an open mind, you see. Too much garbage gets blown into anything that's left open. And since I have only about six thousand hours a year in which to consider things, I couldn't possibly accept everything for consideration. Maybe you have invisible fairies at the bottom of your garden who give you regular messages from Saturn. I can't disprove it. But until you come up with some way for their presence to be proved beyond mere testimony, I'm not interested.

Anyhow, the people who go around demanding an open mind from others usually have their own minds closed to almost everything that science has learned in the last sixty years or more.

However, when I mean to review a book, I have to change my attitude somewhat. Like every other reviewer, I have my own particular likes and dislikes, but I try to be fair when reading a book. I make every reasonable effort to look for the virtues as well as the faults to be found in it. And I make it an absolute rule to read all of any book I intend to review as carefully as I can.

The first book of the two chosen this time made careful reading as difficult as possible. This was **The Invisible Landscape,** by Terence K. McKenna and Dennis J. McKenna (Seabury, $12.95, 242 pp.) Just so the title won't put you off, it carries a subtitle: **Mind, Hallucinogens and the I Ching.** It was in that style which is used by social scientists and modern philosophy students to show the level of erudition which they have achieved.

A small sample will suffice: "The motion of concrescence signifies an abyss of ambiguity, for once the monadic hierarchy enters the short epochs preceding concrescence, the normal limitations of three dimensions will be obviated." There are also a great many quotes from Whitehead and other authorities to indicate that the authors have given thorough study to the literature.

Now there is nothing wrong with the use of professional language in material meant for professional study, where the purpose of such language is to insure exactness of meaning. But this is apparently meant for the general audience, where many of the terms tend to make communication difficult. Furthermore, even with careful reading, I found it difficult to discover much meaning in many long passages.

Anyhow, the book begins with a discussion of shamanism. (One of the authors holds a degree in shamanic studies.) Apparently the authors are convinced that the shamans held a key to something that is missing badly in modern society.

We all know, of course, that primitive societies were much more rewarding than modern ones! Oh, maybe the people died off much earlier, suffered more from hunger and disease, and tended to be unable to compete with more modern peoples. But don't let little things like that fool you. Go read your Rousseau!

Anyhow, they were interested in the trance state which is induced by some shamans through the use of hallucinogens. There's a good

deal about the chemical nature of hallucinogens and their effects on the mind, with the general idea that such drugs break the barrier separating the "conscious" mind from the unformed archetypes of the collective unconscious. (They also accept the holographic theory of memory, which perhaps makes it easier to believe in a large body of inherited archetypes.)

So they went down to South America where there were shamans among the primitive tribes. There they were able to indulge in some of the native hallucinogens. According to their testimony (and generally, testimony by participants about what happens under such drugs isn't quite as valid as that of participants plus trained observers), they heard strange sounds and had a strange experience of being separate from time, or able to observe time. (This is something I've heard about from others who took such drugs.)

From this, they somehow arrived at the idea which forms the second half of the book.

This deals with the idea that the ancient *I Ching* can be used to show time; as an example, there are 64 hexagrams, each having 6 lines, which multiply to give 384—the number of days in 13 lunar months. By various further multiplication by 6 and 64, they can come up with long cycles. There is also seemingly a possibility of mapping a "Wave of Time," for which they used a computer. There are a number of charts and computer readouts to demonstrate this.

Great stuff, no? And very clever of those ancient Chinese to discover how time works. But then, of course, we know that ancient peoples were much smarter—at least intuitively—than we are; and of course anything from oriental thought must be far ahead of our puny efforts. I mean, man, you know—

All right, so far the book has given a great deal of rehashed theory about how the mind works and the effects of hallucinogens, plus an account of the drug trip they took. All we really have to get our teeth into, so far as I can discover, is their *I Ching* theory. Does it seem to fit anything we already know? That is the only way we can test it, after all. (Anyone can come up with a theory about anything; the usefulness of the theory is determined by its general fit into known facts and its ability to predict new facts.)

Well, summarizing, they derive the beginning of the universe 36 billion years in the past—twice as long as most astrophysicists believe, as they say. That isn't subject to enough certainty yet to mean much. But they go on to say that life began 1.3 billion years ago—and there is pretty firm evidence by now that life began more than twice that far in the past. Then they give the emergence of *Homo sapiens* as occurring 275,000 years ago. Whoops! The most recent evidence simply doesn't agree there.

Such grand sweeping figures, however, don't really mean much. The only way to test the theory fully would be to take the major dates of history and run back 67 year period by 67 year period.

There it's hard to agree on what are important dates, of course. But they list the last major date as 1945. Going back from there, they miss the American Revolution, the discovery of America, the Battle of Hastings, and a few other things. I'd guess that the discovery of the new world should be there. They might disagree.

And what we really have is another of those damned theories that can be proved conclusively to the satisfaction of the theorists but has exactly no value anyone else can see. It sounds learned and profound. So did the theory of phlogiston—with more reason.

And to me, it nicely illustrated the true value of hallucinogens in opening the mind to anything of any real value. It's interesting to me how often the use of such drugs later leads to the discovery of some great truth from the cults, ancient or modern. I'm still waiting for the great new scientific advance to come from the use of drugs. But then, of course, the hallucinogens have only been used for a few thousand years, so far as we know.

The Living Aura, by Kendall Johnson (Hawthorn, $15.00, 178 pp.) is a strange but somewhat more interesting book. It deals with Kirlian (sometimes called Kirilian) photography, here somewhat more properly called radiation field photography. This has recently been blown up all out of proportion by some of the cultists. The title of the book seems to accept the cult ideas fairly seriously, since such photography has often been claimed to prove the existence of human auras. But the book itself has little to say about that. Probably the title is the responsibility of the publisher.

Incidentally, human beings do have an aura in one way—they exist at a temperature of more than 300° Kelvin, warmer than their surroundings, so they radiate infra-red radiation—or heat—which can be photographed with the right equipment. But then, a frying pan taken off the stove will yield a far brighter and more interesting aura! This has nothing to do with the mysterious aura postulated by the cults.

The book is rather naïvely written, but it's straightforward and easy to read. When the author can't understand something, he admits it cheerfully. He doesn't pretend to be a real scientist. (He got into this as a result of taking a course in parapsychology.) He gives some details on taking such photographs, along with warnings about potential danger, but no real details on the equipment he used.

Briefly, this began in 1939 when Semyon Kirlian, together with his wife and some other Russian scientists, discovered the process, though it was known before. If a film negative is laid on a flat metal plate with the object laid on the film, a "photograph" can be made by connecting one pole of a high-voltage source to the plate and the other to the object. Varying the polarity, the voltage, and the exposure time will make considerable alterations in the results. (In some experiments, the frequency and wave-form will

also alter the results.) Johnson discovered that it was possible to get results by scuffing feet across a carpet and using the static built up thus to make the exposure.

Some of the black and white as well as the color "photographs" in the book are extremely attractive; the "corona" effect around the object is often fascinating. And Johnson points out a few genuine uses for the process, such as detecting cracks in metal or photographing the imprint of serial numbers supposedly removed from equipment. (There are other ways to do such things, of course.)

I might smile and forget the book with no hard feelings to Mr. Johnson, who sounds like a very decent person, despite his leanings toward things that irritate me. But this is going to be used by a number of the cults to prove again what they *knew* all along. The fact that the book is introduced by Dr. Thelma Moss (Johnson's professor of parapsychology) gives it the true scientific authority. It's funny about people who love to believe what most scientist regard as nonsense; they scream and rant about the scientific community's conspiracy to suppress them and curse scientists—until someone with a degree seems to support one of their statements. Then they go into a gleeful ecstasy!

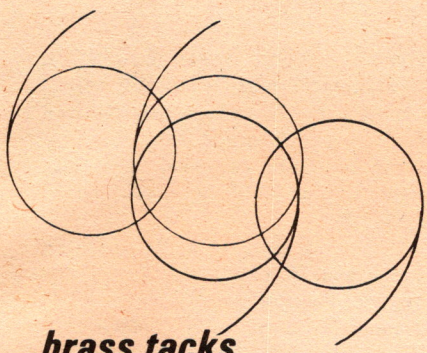
This, as far as they are concerned, will prove positively that every human being (except perhaps scientists who disagree) has an aura. The fact that a dead and preserved finger also showed quite an "aura" won't mean anything, either—or that a number of non-organic substances also showed such Kirlian auras. Johnson referred to his work as photographing the non-material world without a camera. Isn't that proof?

Well, of course electricity isn't exactly non-material. Electrons do have mass, so they aren't non-material. Neither were the objects photographed. (Photons *don't* have mass. Does that make normal photography a spiritual affair? Ed.)

But people seem to need in the most desperate manner to be assured that they aren't mere gross, material animal forms. A great many people have to feel that inside them is something supernatural or divine which gifted or sensitive others can perceive. Somehow, that makes them important, no matter how insignificant they have let themselves become in life. And strangely, they also like to believe that "Eastern" beliefs and very ancient knowledge are better than anything they ever developed—despite the fact that people in ancient times and in those wonderful Eastern lands seem to have done nothing with such knowledge to eliminate the relative misery of their people. I also wonder why the idea that such other people were so superior to us doesn't make our believers feel even more inferior.

I suppose, however, that if people were rational, books like these would never be published. 'Tis a consummation devoutly to be wished.

And if anything I've written here offends you, send your complaints to the editor! Me, I've got a closed mind. ■



brass tacks

Dear Mr. Bova,

Your fact article in the January 1976 issue, by Henry Sauter on Solar Heating, interested several of us over here, where by coincidence there started on a commercial TV channel the first program of a thirteen-week series on building a Solar home which aims to cut fuel consumption by a comfortable 80 percent. . . .

As General Secretary of the British Association of Inventors—known to members as "BrAIn"—I am intensely interested in this subject, along with other interests in advanced air-weapons and two-cycle petrol-engines, and with my brother, thinking of constructing a low-grade-heat-pumping system to achieve similar results to your outlined system, but by alternative means. Other members are also interested, with the unfortunate difficulty that we do not include in our midst any refrigeration engineers; a man skilled in systems design in that field would be a very valuable addition to our numbers!

Any system being installed must bear a direct relationship to expected patterns of weather-behaviour. Here in the Midlands of Britain we are immensely influenced by the regular and frequent arrival of North Atlantic Lows. Sunshine occurs around 250 days a year, but is not continuous. Freezing is rare . . . High winds, or more usually blustery gales, are not uncommon, and only last week we had gusts up to 105 mph., and 24 deaths overnight on Friday. This makes any added overburden in roof areas somewhat less than desirable. . . .

As a group, we would like to see a comprehensive book published on the subject of the EconoHouse, with a minimum of basic designs, each having tables and charts showing the dimensional variations in surface-areas, pipe-diameters, pump-capacity and tankage for storing, transfer and dumping, together with constructional data on all the other hardware, for both the Solar-roof and ground pick-up systems; and do not ignore the possibilities present in using man-made lakes as the source for low-grade-heat installations.

Establishing engineering standards is an aspect of the subject which should not be overlooked; corrosion resistance, conductivity, insulation and material specs are all equally necessary to the success of the system, particularly if it plans to meet the needs of the do-it-yourself house-conversion market. We have already decided upon metric dimensional standards, due to the distance Britain has gone in the metrication process.

For the low-grade heat system we are working on an expected material cost from $1000 to $1250

all-in. It would appear that the Solar-roof system would make our project even more complete: the roof supplying heat on sunny days, and the ground on cloudy days—albeit at a higher cost for pumping. However, the total costs for the complementary installation may be inordinately high at this stage of the game. It would, on the other hand, fit in very well with the usual phenomenon of bright sunshine being prevalent on the days the ground is frozen, due to these conditions being associated with same stationary high-pressure zones.

We would like to see details being made freely available, and construction made possible without exorbitantly high royalty-charges, together with tax-concessions, to help encourage even the less wealthy members of Western civilization to accept the challenge, and to maintain the standards to which we are accustomed.

B.A. MARTIN

99, Northdown Road,
Solihull,
West Midlands B91 3ND,
England

This is an area where the individual citizen can provide his own answer to the energy "crisis," without waiting for Big Government or Big Business to implement a costly and complex master plan!

Dear Mr. Bova,

Richard Carrigan's February article, "The Discovery of the Gypsy," was well-written, very entertaining, and even more informative than I had any right to expect.

Since *quark* means nonsense in German, should these elusive but fundamental particles of Dr. Gell-Mann's be found, we will then have scientific proof that the universe is made of sheer nonsense. How happy Voltaire would be to know that.

KENNETH A. RUMBARGER

123 Poplar Avenue
Wayne, Pa. 19087

One of the purposes of science is to make sense from non-sense!

Sir:

I don't write letters to editors. I do quite often send in AnLab voting cards, because no system can operate optimally without a modicum of feedback.

But, to the point: On December 9, 1975 I watched a one-hour show on NBC. It was a piece of the special programming NBC has been tucking away in the 3 p.m. time slot, aimed specifically at children. I watched this one because it had been advertised all over the tube for the preceding week as enlightening, educational, and very probably the greatest thing since "2001."

Titled "The Day After Tomorrow," it dealt with two families aboard a photon-drive starship destined for Alpha Centauri. The script was by someone named Johnny Byrne. The main production and direction appear to have been done by Gerry Andersen, one half of the infamous team of Gerry and Sylvia Andersen. If you don't recognize the names off-hand, this pair has manufactured such gems as "U.F.O." "Space: 1999;" and a Saturday morning puppet show

called "Fireball XL-5." Personally, I feel they overreached themselves with the puppet show.

In "The Day After Tomorrow," I counted a dozen major errors in the first eleven minutes and stopped keeping score. A few examples: The magical photon-drive ship manages to accelerate itself to approximately C in a minute or so, and the passengers merely experience high gee. From the viewpoint of the launch station, the ship undergoes a marked red-shift at about point ten C.

The magical spacecraft has to accelerate to go somewhere, but there is no mention of deceleration at any point. Receding planets do red-shift, but incoming radio/TV transmissions apparently don't have to be shifted up- or down-spectrum.

Transition to Alpha Centauri is effected almost instantly (with no deceleration, remember) and the crew never seems to eat, sleep, or use the head. The crew had all the personality of poorly reanimated zombies, and the navigators used slide rules. That's right, slide rules.

At no point was the time-dilation effect explained.

I'm also curious about the source of fuel. The photon-drive apparently just keeps pumping out light with no input. (There is an atomic reactor, whose environs are suddenly non-radioactive when it is shut down; type unspecified.)

I'd believe a Bussard ramship, but apparently Andersen hasn't heard of it yet.

A few of the other high spots—rocket motors that make noise in a vacuum; people who stare out of unprotected ports at a red giant about to go nova; females who get hysterical; males who don't; Hurst gear-shift linkages used as control levers in the control panel; emergency override controls that can't be reached from the seated position; and a spinning hypermass that can be passed through on a randomly selected flight path.

The kids who watched it with me thought it was stupid, and I agreed. The six-year-old kept pointing out that the characters were behaving irrationally. . . .

And now the clincher: in the opening credits, emblazoned shamelessly across the screen, were the words, "APPROVED BY THE NATIONAL EDUCATION ASSOCIATION."

I figure the NEA must have forgotten to watch the show, or been over-impressed by the credit line that listed Professor Somebody as a technical advisor. (It's a cinch the scripter either didn't read or didn't understand any technical recommendations; but we're used to that procedure, right?)

DAVID G. POTTER
5700 Franklin Blvd.
Sacramento, Calif. 95824

Most movie and TV producers neither know nor care about science, and their idea of "sci-fi" is to spend all their money on special effects (most of which are lousy) and let things like script, acting, directing, etc. work themselves out on half a shoestring. I worked as a science advisor on a TV series; if you want to see what goes on behind the cameras, take a look at THE STAR-CROSSED (Chilton), which was in-

spired by my brief fling at being a TV science advisor.

Dear Ben:

Have to respond to a letter in the February issue, by Mr. John Majka—you and he both seem to have a misconception, and I may be able to clear things up a bit.

The letter concerned the use of our waste materials as fuels, either through anaerobic digestion or some other procedure, and you comment "Many such schemes have been proposed, and the standard answer from industry and government is, 'It can't be done.' "

I'm afraid the answer is becoming more "We're doing it." Here's a little data, just off the top of my head:

-About 5-10 cities or regions taking their combustible solid waste and converting it to power through pyrolysis, digestion, chemical treatment, or simple grinding and feeding it into coal fired plants at about 5-15% mix. Another 10-20 in advanced planning. Examples include most of Connecticut, Baltimore, St. Louis, Chicago, Ames, Iowa . . .

-Many, many attempts at waste treatment plants to power the plants with digestion gasses; but they've generally failed because the waste isn't clean enough—the oils and greases stop the gas bubbles because they float on the top . . .

-A few pilot projects, mostly on the West Coast, to trap methane generated in landfills, clean it from the CO_2 also produced, and burn it. Anaerobic digestion in a 100-foot deep dry landfill will keep things going 20-50 years.

-Lots of work with specialized products, such as waste tires, conversion of farm wastes into yeasts, fuels, mostly in early stages.

Up to about 1970, you were right about the response. Since then, though, cities have run out of landfill space, energy costs have risen, environmental laws have gotten tougher, and the trend has been towards more recycling; lately, that trend has been towards energy conversion, because it's more likely to sell to local citizen groups (many cities will accept any technology, whatever its cost, if they can convince their people to let it in).

Household refuse is going towards energy production full speed. Effective use of the waste (generally by direct conversion, with the fewest links in the chain) will generate about 25% of household electricity use.

Energy production from sanitary wastes is more questionable—we're already spending gigabucks on just getting the stuff out of the rivers (or, more likely, partially out), and adding constraints will just slow things down. More reasonable is probably to land-spread the sludge for fertilizer, cutting down on energy use in producing it. That's another technology that's coming out of the development stage.

The real place where energy can be gained is in the conversion of manures, stalks, and so forth from feedlots and farms. Several feedlots are generating their own power from their wastes, and others are using the wastes to fertilize the grain needed to feed the beef that makes the . . . you can take it

from there. There's federal support for demonstrations here—EPA, ERDA, NSF—and there are real problems in collecting the stuff in any useful way, and also in replacing turned-under stalks with fertilizer.

As far as I can tell, from six years in the waste processing field, the federal government is interested but not particularly active, and industry is generally putting in the money. Federal seed money and demonstration grants have helped, but this is one area where they have stopped with demonstrations, and let the local governments and private sector continue. (P.S. The only reason we have so much coal is the time frame: give me garbage from 10^8 years, and I'll get a lot of energy too.)

JAMES F. HUDSON, PH.D.
Urban Systems Research &
Engineering, Inc.
1218 Massachusetts Avenue
Cambridge, Mass. 02138
Always glad to be corrected by facts.

Dear Mr. Bova:

The lack of an index to Analog is a dang nuisance. I wanted the author of a story I recall reading in Analog and had no recourse but to read the title pages of my entire collection. With the associated rereading of goodies, it took days and I never did find the story. (I'm afraid you can't help me; I've forgotten the title too. All I remember is that your comment at the beginning gave away the plot, a sin Analog rarely commits.)

JOE AGAPI
There is an Index to science fiction stories, published annually by the New England Science Fiction Association. Their address is NESFA, Box G, MIT Branch Station, Cambridge, Mass. 02139.

Dear Ben:

RE: "The Winnowing," by Isaac Asimov (February 1976).

The Good Doctor seems to have a weird idea of Justice in that story. I honestly cannot see that starving the entire world population to death is a noble thing because it will obtain equality. John Campbell didn't either, as I recall, so I find the story a bit out of place in Analog. But dropping the "You aren't Campbell" stick that you have been beaten with for so long, let me get down to points . . .

Let us propose alternatives:

-Would the professor in the story have been happy to see everyone in the industrial nations sent to farms involuntarily to provide food for the starving masses of Booga-boogastan? And to see all of his marginal research work cut out, so that he would be reoriented to becoming a slave to said starving masses of Booga-boogastan?

If Justice is equality, then everyone at the level of the lowest primitive is good and desirable, is he not?

-Would Booga-boogastanis learn to kill rats, monkeys, vermin and other pests that eat their crops? Would they throw away their culture, accepting that living past age 20 and not having dead babies . . . is worth more than the traditions of their fathers? Would they learn to feed themselves, or would they ev-

ermore seek to improve their national arsenal?

You cannot accept 20th century technology and keep a 1st century social system.

-Could Booga-boogastan raise the price of some desirable natural resource that only it can provide to the level that it can begin to get its act together?

Justice does consist of equal exchanges, freely engaged in by free people. And a "fair price" is whatever both of them can arrive at.

Well, the first alternative is a dead end that would close down the world for everyone, and for all the people yet unborn who would lose out on the technology that might have been.

A.C. Clarke uses the example of the satellite TV broadcast to educate the masses of India; if the industrial nations had not invested in the research (as opposed to mailing food over) there is no way that these people could be reached for the same cost.

Alternative two doesn't look too hopeful. Why should they change when they have allies like the soft, sweet old professor to see to it that they get a free ride? Further, since "justice" demands that they be given food, why should they develop any resources of their own? Better to buy a nuclear bomb, and be a big man on the block.

I'm not saying that alternative two will not work. In the case of Japan, they built an industrial state by jumping from the middle ages to the 20th century in a very short time. I just don't see much hope for the other developing nations. Maybe there is a good idea for a story.

Alternative three we are seeing taking shape in the Arab oil nations. And it is doing a fairly good job, too. They now have the money to build a native food supply that can support its own population—if they will stop killing themselves and learn something from Israel.

I'm not wildly happy about the idea of mass, random murder that the bad guys of the story were about to engage in. Doing nothing to help them is moral and would have taken the same toll as the proposed poisoning. No one is required to provide for someone else just because they were born; that is called slavery.

Anyone got another alternative solution to the problem?

JOE CELKO

Box 11023

Atlanta, Ga. 30310

The Good Doctor replies:

"The Winnowing" was not intended to offer an answer. It merely asked a question. Mr. Celko, however, offers an answer, much of which is summarized in his sentence: "You cannot accept 20th century technology and keep a 1st century social system."

I agree—but how do you persuade people to give up a backward and outmoded social system? I have just read *Gone With the Wind* (and loved it) and it made me realize how difficult it was to get Georgia to give up an outmoded social system. It took a war and reconstruction, and both of them were rotten. How would Mr. Celko have done it?

EDITORIAL, *continued from p. 9*
alternative—with all that this implies in terms of free flow of information across frontiers, and the abolition of today's artificial barriers. (As the debates on the subject at the UN have shown, some people are very worried about this.) Before the end of this century, the communications satellites will have decided whether English, Russian, or Chinese is the second language of mankind.

In August 1971 I was asked to address the ambassadors of the nations gathered at the State Department to sign the agreement setting up Intelsat. I'd like to quote some comments I made then.

"I believe that communications satellites can unite mankind. Let me remind you that, whatever the history books say, this great country was created little more than a hundred years ago by two inventions. Without them, the United States was impossible; with them, it was inevitable. Those inventions, of course, are the railroad and the electric telegraph.

"Today we are seeing on a global scale an almost exact parallel to that situation. What the railroads and the telegraph did here a century ago, the jets and communications satellites are doing now to all the world.

"I hope you will remember this analogy in the years ahead. For today, whether you intend it or not—whether you *wish* it or not—you have signed far more than just another intergovernmental agreement.

"You have just signed a first draft of the Articles of Federation of the United States of Earth."

I don't believe this is mere hyperbole. What we are seeing now, largely as a result of space technology, is the establishment of supernational global-service organizations in which all governments in their own sheer self-interest will simply *have* to co-operate. Intelsat is the obvious prototype. The World Weather Watch, in which meteorological satellites are an essential element, is another. And the dramatically successful Earth Resources Satellites, Landsat 1 and 2, may be the precursors of a sort of global inventory, not only surveying all our planet's resources, but also monitoring their misuse through pollution and environmental degradation.

Our children will be unable to understand how we ran our world without these tools of space. The answer, of course, is that we didn't.

I'll say no more about application satellites, because there can now be little argument about their value—only about the priority given to each type. Let's move on now to the more controversial subject of scientific space exploration and manned space flight.

It is almost impossible to overpraise the achievements of the space probes—Ranger, Orbiter, Mariner, Pioneer—that during the

last decade have revolutionized our knowledge of neighboring worlds. Let us hope that the forthcoming Viking missions, potentially the most exciting of all, are equally successful. But how many people know about the discoveries that these robot explorers—our scouts into the new wilderness—have radioed back from Mars, Mercury, Venus, Jupiter? It's a great tragedy that the United States has lost the most effective medium for spreading news of these adventures in science, the glossy magazines like *Life* and *Collier's*, which played such an important role in promoting the space age. The pictorial riches stored up in NASA are almost unknown to the general public; apart from a few specialized periodicals, the *National Geographic* is now about the only display forum for this superb material. And though the *Geographic* does a magnificent job for a large and influential audience, it hasn't the vast coverage of the old *Life*. I don't know what, if anything, can be done about this p.r. problem, which concerns the whole of science and not merely astronautics. If it could be solved, the deep space research program would be in good shape.

With regard to manned space flight, we have at least settled one old controversy. I can remember the time, not long ago, when it was solemnly asserted that men could not survive zero-gravity for more than a few hours. Well, we've now seen that they can function happily in space for months; indeed, it appears that some would be happy to stay there indefinitely, as long as their wives or girl friends could join them. (Or, for that matter, their husbands or boy friends.)

During the last year there has been much publicity for the idea of 'colonies in space', and it has even been suggested that they could provide a solution to some of today's problems. This idea is very old; it was developed in remarkable detail by the great Russian pioneer Tsiolkovski as early as 1911 and by J. D. Bernal in the 1920s. I have not the slightest doubt that such schemes will eventually be realized. Indeed, many years ago I stated that *in the long run* there will be more people living off the Earth than ever lived on it.

But that is looking a century or so ahead, and I don't believe that we should concern ourselves with vast space cities this side of 2001. The technical problems are so enormous—there are so many possibilities for disaster owing to some trivial oversight or violation of ecological principles—that we must first prove we can make cities work down here before we design Astropolis. I'm almost tempted to quote Vannevar Bush again: "I feel confident that it will not be done for a very long period of time to come. . . . I think we can leave that out of our thinking." I may be as wrong as Dr. Bush . . . and Profes-

sor O'Neill may be right.

What we *should* start thinking about now are space villages, not space cities. We will need them in the quite near future for the industries and services that will undoubtedly be established in Earth orbit.

(Incidentally, it's amusing to note that the very first suggestion for a manned satellite was made a little more than a hundred years ago by none other than the Chaplain of the Senate—Edward Everett Hale, in his story "The Brick Moon".)

Even today, some of the reasons why we'll need men in orbit are quite obvious. Much complex scientific equipment can only be assembled, checked, and refurbished if there are men on the spot to supervise operations. The Large Space Telescope is an excellent example. A permanent manned crew isn't necessary—indeed, in this case it's actually undesirable!—but access from time to time is essential. Much of the cost of today's satellites stems from the fact that they have to be built for absolute reliability, and have to perform complicated deployment maneuvers automatically after they are launched. It's been said, with perhaps only slight exaggeration, that there are billions of dollars of useless satellites in orbit right now that might be fixed by men with screwdrivers. To quote Churchill, this is nonsense up with which we shall not put.

One dramatic possibility, which doubtless has already been presented to your committee, is that of the orbiting solar power plant, several kilometers on a side, which would obviously have to be assembled over a long period of time by manned crews. However, it is very hard to believe that this could compete economically with ground-based installations in desert areas; but one day we will certainly have to go into space to tap the limitless energies of the Sun. When that day comes we may go much closer—say to Mercury, where there is ten times more power available per square meter than in Earth orbit. Moreover, Mercury, which is much denser than the Moon, probably contains vast quantities of metals. So *that* is where we may locate the heavy, polluting industries of the centuries to come, shipping the finished products back to Earth. If this sounds fantastic, please remember that the cost of transporting material *across* the solar system is quite small even with present techniques; it's getting *away from Earth* that's expensive. This won't always be the case; I'll return to that theme later.

As our civilization becomes more and more reliant upon applications satellites of ever-increasing power and complexity, it will eventually be essential to have permanent servicing and maintenance teams in orbit (probably in the 36,000-kilometer-high synchronous orbit,

where most of the action will be). This state of affairs will arise before the end of the century as a result of *foreseeable* developments. It may be accelerated by discoveries in zero-gravity processing, space medicine, and so forth.

And apropos of space medicine, I would like to mention a cautionary fable I wrote exactly fifteen years ago. By another odd coincidence it takes place just around now, much of it in the building across the road. . . .

It concerns a United States Senator, who at a 1975 hearing of the Committee on Astronautics shot down the NASA Administrator so effectively that he couldn't get the funds to build a manned space station. As a result the Russians pioneered space hospitals, where amongst other things heart-patients could recover under the stress-free conditions of zero-gravity. You can doubtless guess the sequel: the Senator found *he* had a heart defect, and though the Russians were willing—indeed, delighted—to treat him, he realized that he had morally forfeited the right to avail himself of the still limited facilities. Hence the story's title: "Death and the Senator".

Now, I said that this piece of space propaganda was a cautionary fable, and even in 1960 I didn't intend it to be taken as serious prophecy. But I *am* serious about the underlying message: there will be countless direct human benefits from space research which we cannot anticipate today; and if we do not keep our options open, we shall miss them—or, what is almost as bad, be unable to exploit them when the time is ripe.

Hence, of course, the importance of the shuttle, of which this committee has heard a great deal and will be hearing a great deal more. It's unfortunate that the shuttle, once touted as the DC-3 of space, has now been degraded for fiscal and other reasons to the DC-1½. But it's the only shuttle we have, and perhaps the only one anybody is likely to have in the '80s—so we must make the most of it. If all goes well, it should provide the final convincing demonstration of the need for men in space, not just on occasional sorties but as full-time workers. And this in turn will create a demand for cheaper and better methods of space transportation—exactly as happened with aviation.

Even according to the most optimistic estimates, the shuttle, though an essential intermediate stage, is still orders of magnitude too expensive. Yet in terms of mere energy, space travel could be one of the cheapest forms of transport since the old sailing ships: the basic cost, in kilowatt hours, of lifting a man completely away from Earth is $10; the cost of shipping him round the solar system is about the same. In principle, the communications and life-support equipment

should cost far more than the propulsion.

There is no way of getting anywhere near these theoretical figures with today's—or tomorrow's—technologies. We need new scientific breakthroughs; we've been using up our store of fundamental knowledge at a dangerous rate, and are running out of know-how. In fact, there have been almost no really new ideas in the field of astronautics for the last fifty years; you'll find practically all the things we are doing today outlined, at least in principle, in the classic works of Tsiolkovski, Goddard, and Oberth (who incidentally celebrated his eighty-first birthday last month).

How will we find the new ideas we need? In the usual way—by keeping our eyes open, and by programmed luck, or serendipity (a word that particularly appeals to me, since Serendip is another ancient name for Sri Lanka). We must always have some people working on far-out, even apparently crazy, concepts. And working by themselves, in their own time, and without having to produce progress reports every six months. For as someone once remarked, if there had been government departments of scientific research in the Stone Age, by now we'd have had absolutely marvelous flint-axes and arrowheads—but nobody would have invented steel.

I'll just mention two advanced ideas that may intrigue you. If I had a dollar to invest in them, I'd put ninety-five cents on the first and three on the second—keeping the other two until something even crazier came along.

Seventeen years ago, two of the world's greatest theoretical physicists, with the formidable backing of Dr. von Braun, Theodore von Karman, General Curtis LeMay, Harold Urey, Arthur Kantrowitz and others, spent some ten million dollars on Project Orion. This was a scheme to launch really large payloads, hundreds of tons, by the use of small nuclear explosions reacting against a pusher plate and a shock-absorbing system. Calculations and flight tests using chemical explosions proved that the project, incredible though it sounds, would really work, and that it would be possible to send large, lavishly equipped expeditions to any of the planets by the expenditure of a thousand or so low-powered fission bombs. Quite a small fraction, say, of NATO's stockpile. . . .

When the Project was killed by the Test Ban Treaty of 1963, Professor Freeman Dyson wrote an indignant article stating that "this was the first time in modern history that a major expansion of human technology had been suppressed for political reasons."

Well, it seems to me that the reasons were rather more than political, for I find it hard to get enthusiastic about any vehicle which

leaves a trail of a thousand exploding A-bombs behind it. But now there is at least the theoretical possibility of a *clean* Orion Project, virtually free of radioactivity. The work that is going on at the moment to trigger fusion reactions with laser pulses would seem ideally suited to such a propulsion system. One can imagine microspheres of hydrogen-deuterium being zapped several times a second during the climb through the atmosphere, and at more leisurely intervals thereafter.

Something of this kind may be demonstrated in the laboratory during the next few years: I am sure that there are some very bright people working on it right now, but I've seen nothing in print. (Maybe *I* shall be zapped as soon as I leave this hearing.) If feasibility can be proved, then a truly exhilarating prospect will open up before us, perhaps at the turn of the century. Space travel will no longer be propulsion limited; we can contemplate the large-scale exploration of all our planetary neighbors.

Now for the crazy idea.

In 1966 a group of oceanographers led by Dr. John Isaacs of Scripps described a true 'skyhook'. They pointed out that it would be theoretically possible to lay a cable from a satellite in geostationary orbit—all the way down to the surface of the Earth! And then, in principle, one could send payloads up the cable by simple mechanical means. An electric elevator to space, on a Streetcar Named Heaven. . . .

I must confess that I didn't regard this as more than a scientific pipe dream until a couple of years later, when Cosmonaut Alexei Leonov gave me a copy of his handsome book *The Stars Are Waiting*, published in 1967. Here it is. Imagine my surprise when I saw that the Russians had come up with the same idea quite independently—the Space Elevator! (Poised, I've just noticed, immediately above Sri Lanka—though presumably the cable ends in Africa, since an equatorial site is mandatory and we're seven degrees north.)

What's the snag? Well, we need far stronger materials than those known today to make the scheme practicable. And there are many other problems; if anything went wrong, we'd have a thirty-thousand-kilometer-high structure crashing down on our heads. But it's certainly worth thinking about—and it would be just the thing to carry down the electricity from that solar power plant.

But the real breakthrough which will open the gate to the universe probably lies in some direction no one can imagine today—any more than, a hundred years ago, one could have conceived of atomic energy. There's a feeling in the air now that something is happening to the foundations of physics: the animals from the nuclear zoo are es-

caping in all directions. New particles are discovered every month; perhaps there are new forces also awaiting discovery, and from them may come at last the old dream of controlling gravity. I'd put my remaining two cents on that. . . .

Finally, a glance at remoter horizons. Less than a year from now the first American Mars lander, Viking I, will descend through the thin atmosphere of our little neighbor—accompanied or preceded, no doubt, by several Marskods. The Soviet Mars program has been much more ambitious than the United States one—and much less successful. But it has earned success, and I hope achieves it; there is plenty for everyone to discover on a world with almost the same land area as Earth.

There now seems little doubt that suitable life-forms could exist and even flourish on Mars. We will be very, very lucky if Viking—or its Russian comrades—detects life twelve months from now. But that possibility exists; if I hadn't spent my dollar, I'd put—oh, five cents on this happening in 1976. And I'd put fifty on life being discovered on Mars *eventually*. Not intelligent life, though even that cannot be ruled out.

The impact of such a discovery could be as great as that of the first Sputnik. It will certainly change the priorities of space exploration. At the very least, it will mean that the whole scientific establishment will jump on the manned-space-flight bandwagon, instead of only a section of it (though an ever-growing section, since the brilliant Skylab missions).

And what about intelligent life? In view of Man's remarkable inability to get along with himself, perhaps it's just as well that there are probably no other rational beings in this solar system at this moment of time. But that they must exist somewhere is now doubted by very few scientists. The only disagreement concerns the possible methods of detecting them. They will already have detected *us;* our radio emissions now fill a sphere containing hundreds of stars.

Doubtless many of you have seen the NASA-Ames Project Cyclops report, outlining the technology for a very large radio telescope and the associated signal-processing equipment, which would give a good probability of detecting intelligent signals from space. Cyclops would inevitably contribute so much to the development of radio astronomy that it merits building for its own sake, and it could be an internationally funded, global project that would challenge the imagination of all mankind. There may be no other way in which we can discover—or perhaps establish—our position as intelligent beings in the hierarchy of the universe.

For this, in the long run, is what space exploration is all about. And

that is why those of little courage or little imagination are so often opposed to it.

A few weeks ago, I am sorry to say, a British minister who shall be nameless (actually he has several names) held up the first sample of North Sea oil and declaimed that it was more important than the Moon shot, which "only brought back soil and rock." Well, even for a British minister, whose attention-span seldom extends beyond the next Cabinet reshuffle, this was a singularly shortsighted remark.

Everyone knows that the North Sea oil will be gone in a generation. But the Moon is the first stepping-stone to the riches of the whole universe.

The greatest lesson that we can draw from space is one of hope. In the absolute sense, as far as we can see into the future, there are *no* real limits to growth. It is true that we must cherish and conserve the treasures of this fragile Earth, which we have so shamefully wasted. But if we come to our senses in time, we may yet have a splendid and inspiring role to play, on a stage wider and more marvelous than ever dreamed of by any poet or dramatist of the past. For it may be that the old astrologers had the truth exactly reversed when they believed that the stars controlled the destinies of men.

"The time may come when men control the destinies of stars." ■

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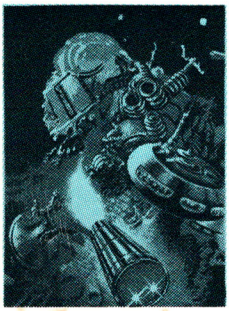

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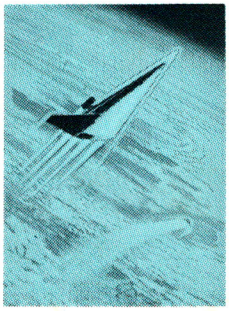

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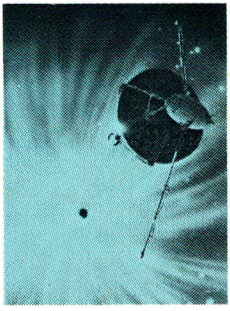

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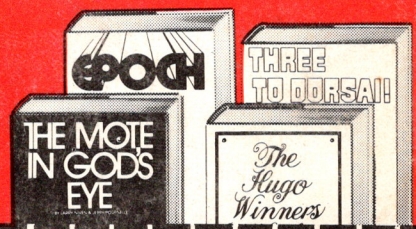

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